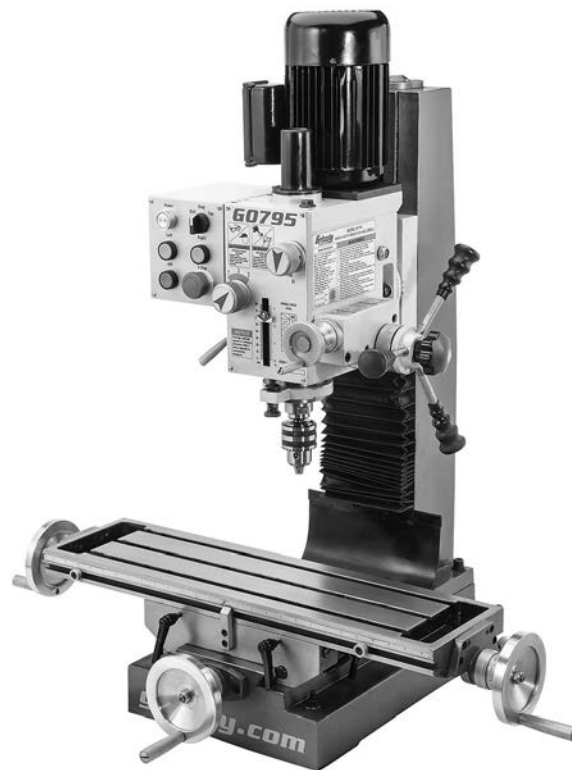


Grizzly **Industrial, Inc.**®

MODEL G0795 **HEAVY-DUTY BENCHTOP** **MILL/DRILL** **OWNER'S MANUAL** *(For models manufactured since 02/19)*



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OR FORM WITHOUT THE WRITTEN APPROVAL OF GRIZZLY INDUSTRIAL, INC.**
#JH17427 PRINTED IN CHINA

V3.04.19



WARNING!

This manual provides critical safety instructions on the proper setup, operation, maintenance, and service of this machine/tool. Save this document, refer to it often, and use it to instruct other operators.

Failure to read, understand and follow the instructions in this manual may result in fire or serious personal injury—including amputation, electrocution, or death.

The owner of this machine/tool is solely responsible for its safe use. This responsibility includes but is not limited to proper installation in a safe environment, personnel training and usage authorization, proper inspection and maintenance, manual availability and comprehension, application of safety devices, cutting/sanding/grinding tool integrity, and the usage of personal protective equipment.

The manufacturer will not be held liable for injury or property damage from negligence, improper training, machine modifications or misuse.



WARNING!

Some dust created by power sanding, sawing, grinding, drilling, and other construction activities contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm. Some examples of these chemicals are:

- **Lead from lead-based paints.**
- **Crystalline silica from bricks, cement and other masonry products.**
- **Arsenic and chromium from chemically-treated lumber.**

Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals: Work in a well ventilated area, and work with approved safety equipment, such as those dust masks that are specially designed to filter out microscopic particles.

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INTRODUCTION

Contact Info

We stand behind our machines! If you have questions or need help, contact us with the information below. Before contacting, make sure you get the **serial number** and **manufacture date** from the machine ID label. This will help us help you faster.

Grizzly Technical Support
1815 W. Battlefield
Springfield, MO 65807
Phone: (570) 546-9663
Email: techsupport@grizzly.com

We want your feedback on this manual. What did you like about it? Where could it be improved? Please take a few minutes to give us feedback.

Grizzly Documentation Manager
P.O. Box 2069
Bellingham, WA 98227-2069
Email: manuals@grizzly.com

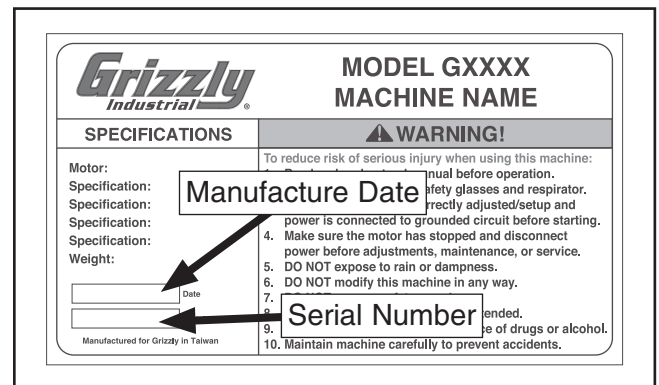
Manual Accuracy

We are proud to provide a high-quality owner's manual with your new machine!

We made every effort to be exact with the instructions, specifications, drawings, and photographs in this manual. Sometimes we make mistakes, but our policy of continuous improvement also means that **sometimes the machine you receive is slightly different than shown in the manual.**

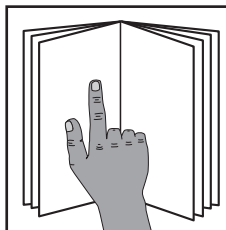
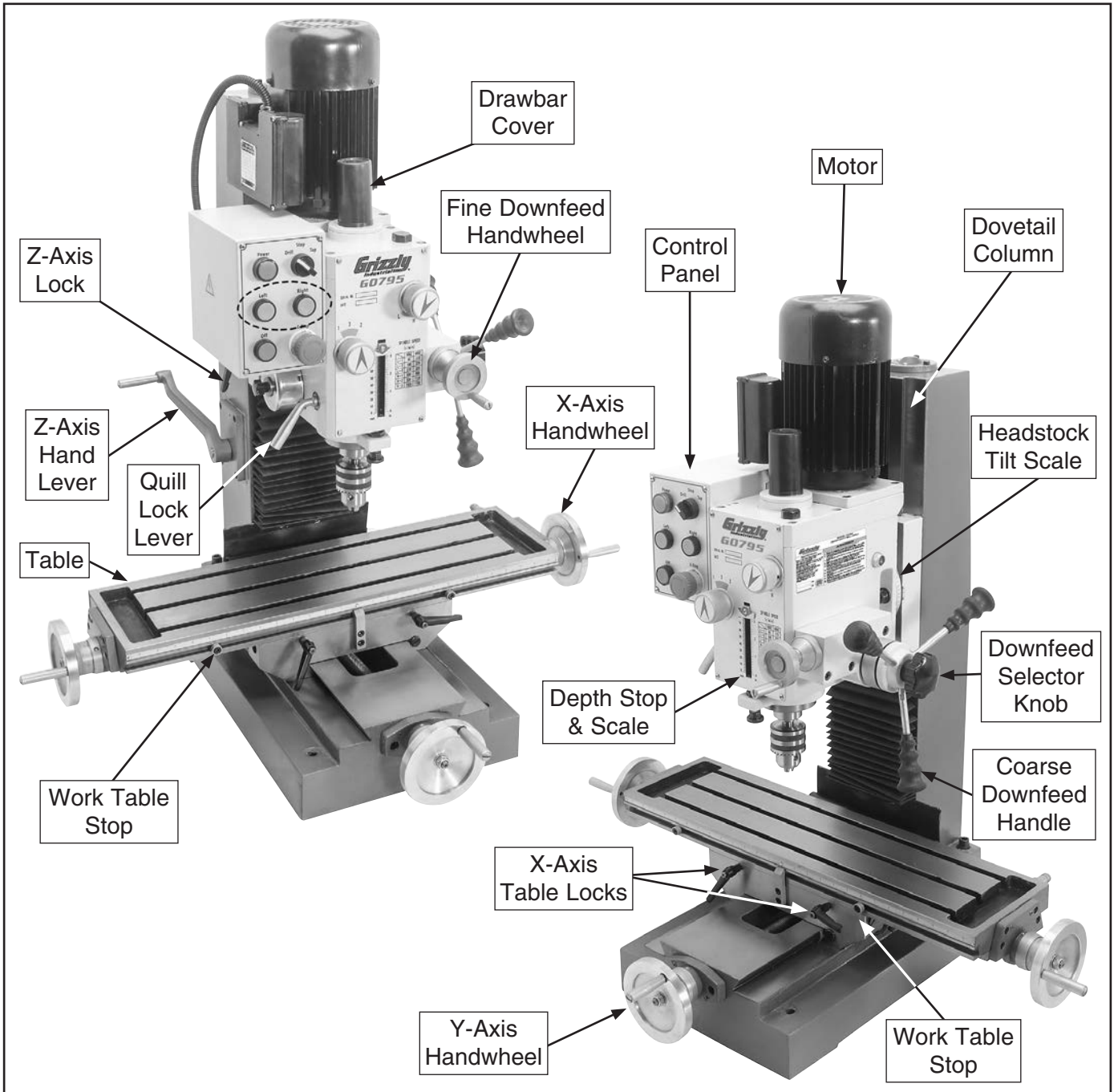
If you find this to be the case, and the difference between the manual and machine leaves you confused or unsure about something, check our website for an updated version. We post current manuals and manual updates for free on our website at www.grizzly.com.

Alternatively, you can call our Technical Support for help. Before calling, make sure you write down the **Manufacture Date** and **Serial Number** from the machine ID label (see below). This information is required for us to provide proper tech support, and it helps us determine if updated documentation is available for your machine.



Identification

Become familiar with the names and locations of the controls and features shown below to better understand the instructions in this manual.



! WARNING

To reduce your risk of serious injury, read this entire manual **BEFORE** using machine.



Controls & Components

Refer to **Figures 1–2** the following descriptions to become familiar with the basic controls and components of this machine. Understanding these items and how they work will help you understand the rest of the manual and stay safe when operating this machine.

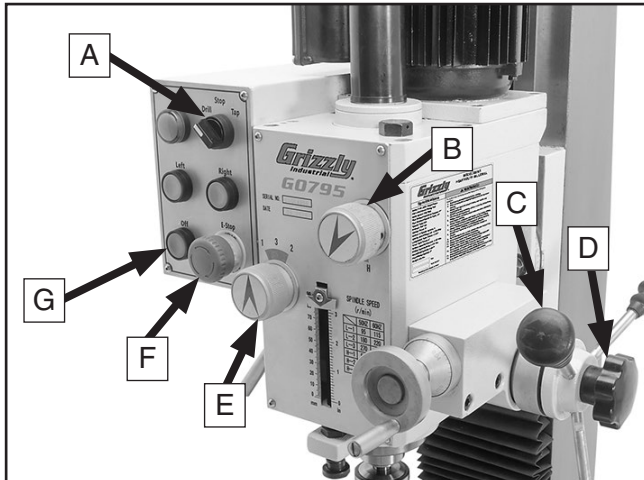


Figure 1. Control panel and spindle speed controls (right view).

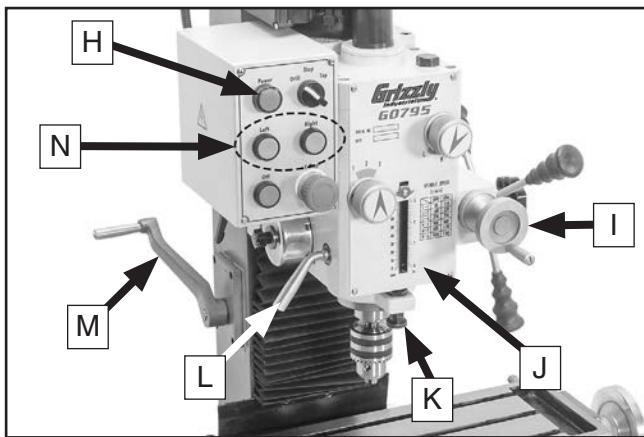


Figure 2. Control panel and spindle speed controls (left view).

- A. Mode Switch:** Sets the spindle mode to either Drill, Stop or Tap.
- B. High/Low Range Knob:** Selects either high or low spindle speed range.
- C. Coarse Downfeed Handle:** Typically used for drilling operations for rapid drilling or plunge cutting. Spring assisted return automatically returns spindle to top position when released.
- D. Downfeed Selector Knob:** Selects fine or coarse downfeed controls. When loosened, coarse downfeed is engaged; when tightened, fine downfeed is engaged.
- E. Spindle Speed Knob:** Selects one of three spindle speeds in the selected speed range.
- F. E-Stop Button:** Cuts power to the spindle motor and remains depressed until reset. Twist clockwise to reset.
- G. OFF Button:** Stops spindle rotation.
- H. POWER Indicator Light:** Illuminates when machine is connected to power.
- I. Fine Downfeed Handwheel:** Moves spindle up and down for precise Z-axis control when milling. Micrometer collar graduated in increments of 0.001".
- J. Depth Stop and Scale:** Limits depth of spindle downfeed stroke to preset height as indicated on the scale.
- K. Depth Stop Adjustment Knob:** Adjusts position of depth stop.
- L. Quill Lock Lever:** Locks quill at desired height above workpiece.
- M. Headstock Elevation Crank Handle:** Moves headstock up and down for proper spindle position during setup.
- N. Spindle Direction Buttons:** Controls spindle direction of rotation (as viewed from above). The spindle must be completely stopped before either button is pushed.





MACHINE DATA SHEET

Customer Service #: (570) 546-9663 · To Order Call: (800) 523-4777 · Fax #: (800) 438-5901

MODEL G0795 HEAVY DUTY BENCHTOP MILL/DRILL

Product Dimensions:

Weight..... 408 lbs.
 Width (side-to-side) x Depth (front-to-back) x Height..... 39 x 30-1/2 x 49-1/2 in.
 Footprint (Length x Width)..... 22 x 14 in.
 Space Required for Full Range of Movement (Width x Depth)..... 52-1/2 x 27-1/2 in.

Shipping Dimensions:

Type..... Wood Crate
 Content..... Machine
 Weight..... 496 lbs.
 Length x Width x Height..... 30 x 29 x 43 in.
 Must Ship Upright..... Yes

Electrical:

Power Requirement..... 220V, Single-Phase, 60 Hz
 Prewired Voltage..... 220V
 Full-Load Current Rating..... 6.8A
 Minimum Circuit Size..... 15A
 Connection Type..... Cord & Plug
 Power Cord Included..... Yes
 Power Cord Length..... 6 ft.
 Power Cord Gauge..... 18 AWG
 Plug Included..... No
 Recommended Plug Type..... 6-15
 Switch Type..... Control Panel w/Magnetic Switch Protection

Motors:

Main

Horsepower..... 1 HP
 Phase..... Single-Phase
 Amps..... 6.8A
 Speed..... 1700 RPM
 Type..... TEFC Capacitor-Start Induction
 Power Transfer..... Gear Drive
 Bearings..... Shielded & Permanently Lubricated
 Centrifugal Switch/Contacts Type..... Internal



Main Specifications:

Operation Info

Spindle Travel.....	3 in.
Max Distance Spindle to Column.....	7-1/2 in.
Max Distance Spindle to Table.....	16-1/8 in.
Longitudinal Table Travel (X-Axis).....	14-3/16 in.
Longitudinal Leadscrew (X-Axis).....	27-1/2 in.
Cross Table Travel (Y-Axis).....	7-1/2 in.
Cross Leadscrew (Y-Axis).....	14-3/4 in.
Vertical Leadscrew (Z-Axis).....	17-3/16 in.
Vertical Head Travel (Z-Axis).....	13-3/4 in.
Head Tilt (Left/Right).....	45 deg.
Drilling Capacity for Cast Iron.....	1-1/4 in.
Drilling Capacity for Steel.....	1-3/16 in.
Tapping Speed.....	115 RPM
End Milling Capacity.....	5/8 in.
Face Milling Capacity.....	2-1/2 in.

Table Info

Table Length.....	27-1/2 in.
Table Width.....	7-1/2 in.
Table Thickness.....	1-9/16 in.
Number of T-Slots.....	3
T-Slot Size.....	7/16 in.
T-Slots Centers.....	2-1/2 in.
X/Y-Axis Travel per Handwheel Revolution.....	0.1 in.
Z-Axis Travel per Handwheel Revolution.....	0.1 in.

Spindle Info

Spindle Taper.....	R-8
Number of Vertical Spindle Speeds.....	6
Range of Vertical Spindle Speeds.....	115 – 1700 RPM
Quill Diameter.....	3-1/2 in.
Drawbar Thread Size.....	7/16-20
Drawbar Length.....	12-3/16 in.
Spindle Bearings.....	Tapered Roller Bearing

Construction

Spindle Housing/Quill.....	Steel
Table.....	Cast Iron
Head.....	Cast Iron
Column/Base.....	Cast Iron
Paint Type/Finish.....	Enamel

Other Specifications:

Country of Origin	China
Warranty	1 Year
Serial Number Location	ID Label
ISO 9001 Factory	Yes

Features:

- 6-Speed gearbox
- Drill/tap function
- Cast-iron construction
- Precision-ground dovetail ways and column
- Coolant trough built into table
- Coarse/fine spindle downfeed w/stops



SECTION 1: SAFETY

For Your Own Safety, Read Instruction Manual Before Operating This Machine

The purpose of safety symbols is to attract your attention to possible hazardous conditions. This manual uses a series of symbols and signal words intended to convey the level of importance of the safety messages. The progression of symbols is described below. Remember that safety messages by themselves do not eliminate danger and are not a substitute for proper accident prevention measures. Always use common sense and good judgment.



Indicates an imminently hazardous situation which, if not avoided, **WILL** result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, **COULD** result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, **MAY** result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTICE

Alerts the user to useful information about proper operation of the machine to avoid machine damage.

Safety Instructions for Machinery

WARNING

OWNER'S MANUAL. Read and understand this owner's manual **BEFORE** using machine.

TRAINED OPERATORS ONLY. Untrained operators have a higher risk of being hurt or killed. Only allow trained/supervised people to use this machine. When machine is not being used, disconnect power, remove switch keys, or lock-out machine to prevent unauthorized use—especially around children. Make your workshop kid proof!

DANGEROUS ENVIRONMENTS. Do not use machinery in areas that are wet, cluttered, or have poor lighting. Operating machinery in these areas greatly increases the risk of accidents and injury.

MENTAL ALERTNESS REQUIRED. Full mental alertness is required for safe operation of machinery. Never operate under the influence of drugs or alcohol, when tired, or when distracted.

ELECTRICAL EQUIPMENT INJURY RISKS. You can be shocked, burned, or killed by touching live electrical components or improperly grounded machinery. To reduce this risk, only allow qualified service personnel to do electrical installation or repair work, and always disconnect power before accessing or exposing electrical equipment.

DISCONNECT POWER FIRST. Always disconnect machine from power supply **BEFORE** making adjustments, changing tooling, or servicing machine. This prevents an injury risk from unintended startup or contact with live electrical components.

EYE PROTECTION. Always wear ANSI-approved safety glasses or a face shield when operating or observing machinery to reduce the risk of eye injury or blindness from flying particles. Everyday eyeglasses are **NOT** approved safety glasses.



WARNING

WEARING PROPER APPAREL. Do not wear clothing, apparel or jewelry that can become entangled in moving parts. Always tie back or cover long hair. Wear non-slip footwear to reduce risk of slipping and losing control or accidentally contacting cutting tool or moving parts.

HAZARDOUS DUST. Dust created by machinery operations may cause cancer, birth defects, or long-term respiratory damage. Be aware of dust hazards associated with each workpiece material. Always wear a NIOSH-approved respirator to reduce your risk.

HEARING PROTECTION. Always wear hearing protection when operating or observing loud machinery. Extended exposure to this noise without hearing protection can cause permanent hearing loss.

REMOVE ADJUSTING TOOLS. Tools left on machinery can become dangerous projectiles upon startup. Never leave chuck keys, wrenches, or any other tools on machine. Always verify removal before starting!

USE CORRECT TOOL FOR THE JOB. Only use this tool for its intended purpose—do not force it or an attachment to do a job for which it was not designed. Never make unapproved modifications—modifying tool or using it differently than intended may result in malfunction or mechanical failure that can lead to personal injury or death!

AWKWARD POSITIONS. Keep proper footing and balance at all times when operating machine. Do not overreach! Avoid awkward hand positions that make workpiece control difficult or increase the risk of accidental injury.

CHILDREN & BYSTANDERS. Keep children and bystanders at a safe distance from the work area. Stop using machine if they become a distraction.

GUARDS & COVERS. Guards and covers reduce accidental contact with moving parts or flying debris. Make sure they are properly installed, undamaged, and working correctly BEFORE operating machine.

FORCING MACHINERY. Do not force machine. It will do the job safer and better at the rate for which it was designed.

NEVER STAND ON MACHINE. Serious injury may occur if machine is tipped or if the cutting tool is unintentionally contacted.

STABLE MACHINE. Unexpected movement during operation greatly increases risk of injury or loss of control. Before starting, verify machine is stable and mobile base (if used) is locked.

USE RECOMMENDED ACCESSORIES. Consult this owner's manual or the manufacturer for recommended accessories. Using improper accessories will increase the risk of serious injury.

UNATTENDED OPERATION. To reduce the risk of accidental injury, turn machine **OFF** and ensure all moving parts completely stop before walking away. Never leave machine running while unattended.

MAINTAIN WITH CARE. Follow all maintenance instructions and lubrication schedules to keep machine in good working condition. A machine that is improperly maintained could malfunction, leading to serious personal injury or death.

DAMAGED PARTS. Regularly inspect machine for damaged, loose, or mis-adjusted parts—or any condition that could affect safe operation. Immediately repair/replace BEFORE operating machine. For your own safety, DO NOT operate machine with damaged parts!

MAINTAIN POWER CORDS. When disconnecting cord-connected machines from power, grab and pull the plug—NOT the cord. Pulling the cord may damage the wires inside. Do not handle cord/plug with wet hands. Avoid cord damage by keeping it away from heated surfaces, high traffic areas, harsh chemicals, and wet/damp locations.

EXPERIENCING DIFFICULTIES. If at any time you experience difficulties performing the intended operation, stop using the machine! Contact our Technical Support at (570) 546-9663.



Additional Safety for Mill/Drills

WARNING

You can be seriously injured or killed by getting clothing, jewelry, or long hair entangled with rotating cutter/spindle. You can be severely cut or have fingers amputated from contact with rotating cutters. You can be blinded or struck by broken cutting tools, metal chips, workpieces, or adjustment tools thrown from the rotating spindle with great force. To reduce your risk of serious injury when operating this machine, completely heed and understand the following:

UNDERSTAND ALL CONTROLS. Make sure you understand the function and proper use of all controls before starting. This will help you avoid making mistakes that result in serious injury.

AVOIDING ENTANGLEMENT. DO NOT wear loose clothing, gloves, or jewelry, and tie back long hair. Keep all guards in place and secure. Always allow spindle to stop on its own. DO NOT stop spindle using your hand or any other object.

WEAR FACE SHIELD. Always wear a face shield in addition to safety glasses. This provides more complete protection for your face than safety glasses alone.

USE CORRECT SPINDLE SPEED. Follow recommended speeds and feeds for each size and type of cutting tool. This helps avoid tool breakage during operation and ensures best cutting results.

INSPECT CUTTING TOOL. Inspect cutting tools for sharpness, chips, or cracks before each use. Replace dull, chipped, or cracked cutting tools immediately.

PROPERLY SECURE CUTTER. Firmly secure cutting tool or drill bit so it does not fly out of spindle during operation.

POWER DISRUPTION. In the event of a local power outage during operation, turn spindle switch **OFF** to avoid a possible sudden startup once power is restored.

CLEAN MACHINE SAFELY. Metal chips or shavings can be razor sharp. DO NOT clear chips by hand or compressed air that can force chips farther into machine—use a brush or vacuum instead. Never clear chips while spindle is turning.

SECURE WORKPIECE TO TABLE. Clamp workpiece to table or secure in a vise mounted to table, so workpiece cannot unexpectedly shift or spin during operation. NEVER hold workpiece by hand during operation.

PROPERLY MAINTAIN MACHINE. Keep machine in proper working condition to help ensure that it functions safely and all guards and other components work as intended. Perform routine inspections and all necessary maintenance. Never operate machine with damaged or worn parts that can break or result in unexpected movement during operation.

DISCONNECT POWER FIRST. To reduce risk of electrocution or injury from unexpected startup, make sure mill/drill is turned **OFF**, disconnected from power, and all moving parts have come to a complete stop before changing cutting tools or starting any inspection, adjustment, or maintenance procedure.

REMOVE CHUCK KEY & SPINDLE TOOLS. Always remove chuck key, drawbar wrench, and other tools used on the spindle immediately after use. This will prevent them from being thrown by the spindle upon startup.

WARNING

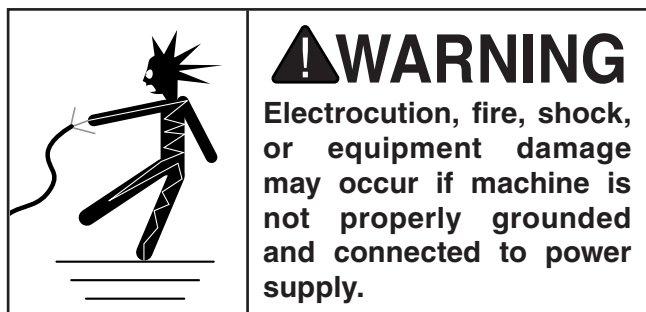
Like all machinery there is potential danger when operating this machine. Accidents are frequently caused by lack of familiarity or failure to pay attention. Use this machine with respect and caution to lessen the possibility of operator injury. If normal safety precautions are overlooked or ignored, serious personal injury may occur.



SECTION 2: POWER SUPPLY

Availability

Before installing the machine, consider the availability and proximity of the required power supply circuit. If an existing circuit does not meet the requirements for this machine, a new circuit must be installed. To minimize the risk of electrocution, fire, or equipment damage, installation work and electrical wiring must be done by an electrician or qualified service personnel in accordance with all applicable codes and standards.



Full-Load Current Rating

The full-load current rating is the amperage a machine draws at 100% of the rated output power. On machines with multiple motors, this is the amperage drawn by the largest motor or sum of all motors and electrical devices that might operate at one time during normal operations.

Full-Load Current Rating at 220V 6.8 Amps

The full-load current is not the maximum amount of amps that the machine will draw. If the machine is overloaded, it will draw additional amps beyond the full-load rating.

If the machine is overloaded for a sufficient length of time, damage, overheating, or fire may result—especially if connected to an undersized circuit. To reduce the risk of these hazards, avoid overloading the machine during operation and make sure it is connected to a power supply circuit that meets the specified circuit requirements.

Circuit Requirements for 220V

This machine is prewired to operate on a power supply circuit that has a verified ground and meets the following requirements:

Nominal Voltage 220V
Cycle 60 Hz
Phase Single-Phase
Power Supply Circuit 15 Amps
Plug/Receptacle 6-15

A power supply circuit includes all electrical equipment between the breaker box or fuse panel in the building and the machine. The power supply circuit used for this machine must be sized to safely handle the full-load current drawn from the machine for an extended period of time. (If this machine is connected to a circuit protected by fuses, use a time delay fuse marked D.)



Note: *Circuit requirements in this manual apply to a dedicated circuit—where only one machine will be running on the circuit at a time. If machine will be connected to a shared circuit where multiple machines may be running at the same time, consult an electrician or qualified service personnel to ensure circuit is properly sized for safe operation.*



Grounding Instructions

This machine **MUST** be grounded. In the event of certain malfunctions or breakdowns, grounding reduces the risk of electric shock by providing a path of least resistance for electric current.

The power cord and plug specified under “Circuit Requirements for 220V” on the previous page has an equipment-grounding wire and a grounding prong. The plug must only be inserted into a matching receptacle (outlet) that is properly installed and grounded in accordance with all local codes and ordinances (see figure below).

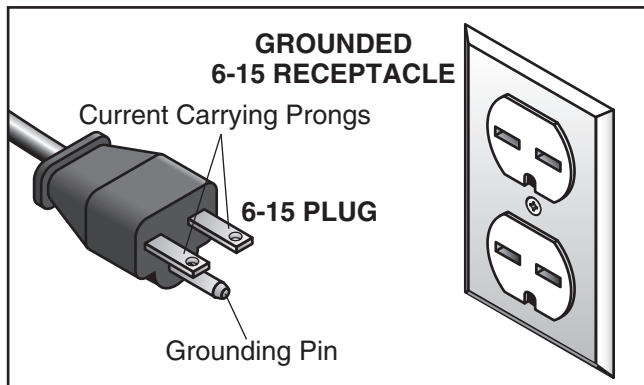
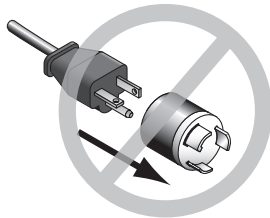


Figure 3. Typical 6-15 plug and receptacle.

⚠ WARNING

Serious injury could occur if you connect machine to power before completing setup process. DO NOT connect to power until instructed later in this manual.

⚠ CAUTION



No adapter should be used with plug. If plug does not fit available receptacle, or if machine must be reconnected for use on a different type of circuit, reconnection must be performed by an electrician or qualified service personnel, and it must comply with all local codes and ordinances.

Improper connection of the equipment-grounding wire can result in a risk of electric shock. The wire with green insulation (with or without yellow stripes) is the equipment-grounding wire. If repair or replacement of the power cord or plug is necessary, do not connect the equipment-grounding wire to a live (current carrying) terminal.

Check with a qualified electrician or service personnel if you do not understand these grounding requirements, or if you are in doubt about whether the tool is properly grounded. If you ever notice that a cord or plug is damaged or worn, disconnect it from power, and immediately replace it with a new one.

Extension Cords

We do not recommend using an extension cord with this machine. If you must use an extension cord, only use it if absolutely necessary and only on a temporary basis.

Extension cords cause voltage drop, which can damage electrical components and shorten motor life. Voltage drop increases as the extension cord size gets longer and the gauge size gets smaller (higher gauge numbers indicate smaller sizes).

Any extension cord used with this machine must be in good condition and contain a ground wire and matching plug/receptacle. Additionally, it must meet the following size requirements:

Minimum Gauge Size14 AWG
Maximum Length (Shorter is Better).....50 ft.



SECTION 3: SETUP

Unpacking

This machine was carefully packaged for safe transport. When unpacking, separate all enclosed items from packaging materials and inspect them for shipping damage. ***If items are damaged, please call us immediately at (570) 546-9663.***

IMPORTANT: Save all packaging materials until you are completely satisfied with the machine and have resolved any issues between Grizzly or the shipping agent. ***You MUST have the original packaging to file a freight claim. It is also extremely helpful if you need to return your machine later.***

Needed for Setup

The following items are needed, but not included, for the setup/assembly of this machine.

Description	Qty
• Additional People	1
• Safety Glasses	1
• Cleaner/Degreaser (Page 13)	As Needed
• Disposable Shop Rags.....	As Needed
• Forklift.....	1
• Lifting Sling (rated for at least 1000 lbs.)....	1
• Mounting Hardware (Page 15) ...	As Needed
• Brass Hammer (Page 16)	1
• Mineral Spirits (Page 16).....	As Needed
• Wood Block (Page 16)	1



⚠ WARNING

SUFFOCATION HAZARD!

Keep children and pets away from plastic bags or packing materials shipped with this machine.

Inventory

The following is a list of items shipped with your machine. Before beginning setup, lay these items out and inventory them.

If any non-proprietary parts are missing (e.g. a nut or a washer), we will gladly replace them; or for the sake of expediency, replacements can be obtained at your local hardware store.

NOTICE

If you cannot find an item on this list, carefully check around/inside the machine and packaging materials. Often, these items get lost in packaging materials while unpacking or they are pre-installed at the factory.

Small Item Inventory (Figure 4)	Qty
A. Drawbar $\frac{7}{16}$ "–20" x $3\frac{1}{2}$ ".....	1
B. T-Bolt M10-1.5 x 60 w/Washer and Nuts....	2
C. Drill Chuck B16, 3-16mm.....	1
D. Drill Chuck Key.....	1
E. Spindle Sleeve R-8	1
F. Bottle for Oil	1
G. Toolbox.....	1
H. Phillips Head Screwdriver #2	1
I. Flat Head Screwdriver #2.....	1
J. Hex Wrenches 2.5, 3, 4, 5, 6mm	1 Ea.
K. Open-End Wrench 17/19mm	1
L. Spindle Wrench	1
M. Handwheel Handle Assembly (not shown)..	2

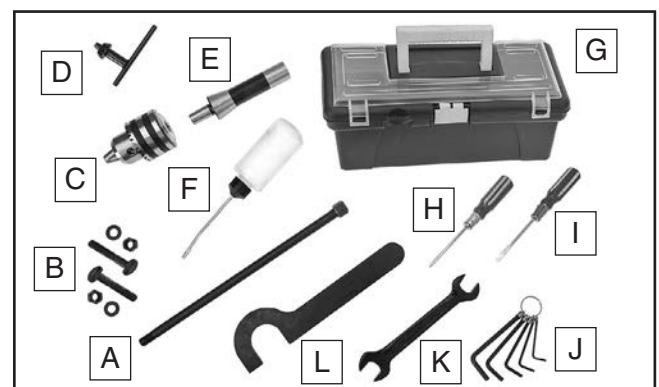


Figure 4. Toolbox inventory.



Cleanup

The unpainted surfaces of your machine are coated with a heavy-duty rust preventative that prevents corrosion during shipment and storage. This rust preventative works extremely well, but it will take a little time to clean.

Be patient and do a thorough job cleaning your machine. The time you spend doing this now will give you a better appreciation for the proper care of your machine's unpainted surfaces.

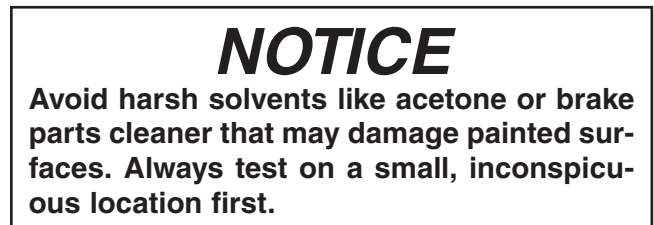
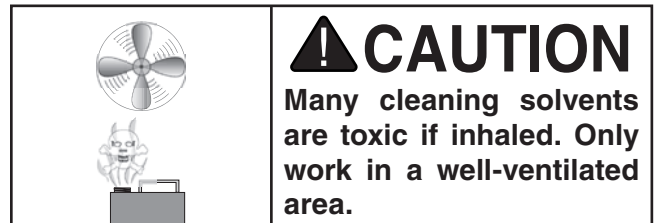
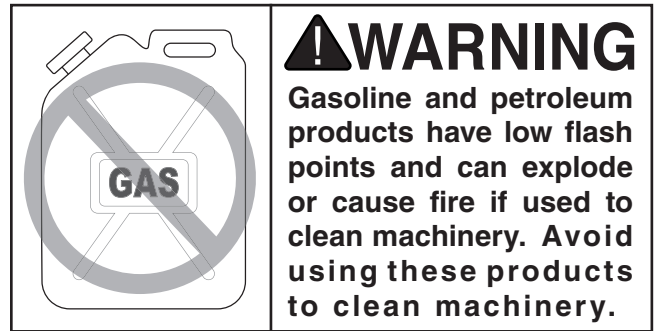
There are many ways to remove this rust preventative, but the following steps work well in a wide variety of situations. Always follow the manufacturer's instructions with any cleaning product you use and make sure you work in a well-ventilated area to minimize exposure to toxic fumes.

Before cleaning, gather the following:

- Disposable rags
- Cleaner/degreaser (WD•40 works well)
- Safety glasses & disposable gloves
- Plastic paint scraper (optional)

Basic steps for removing rust preventative:

1. Put on safety glasses.
2. Coat the rust preventative with a liberal amount of cleaner/degreaser, then let it soak for 5–10 minutes.
3. Wipe off the surfaces. If your cleaner/degreaser is effective, the rust preventative will wipe off easily. If you have a plastic paint scraper, scrape off as much as you can first, then wipe off the rest with the rag.
4. Repeat **Steps 2–3** as necessary until clean, then coat all unpainted surfaces with a quality metal protectant to prevent rust.



T23692—Orange Power Degreaser

A great product for removing the waxy shipping grease from the **non-painted** parts of the machine during clean up.



Figure 5. T23692 Orange Power Degreaser.



Site Considerations

Weight Load

Refer to the **Machine Data Sheet** for the weight of your machine. Make sure that the surface upon which the machine is placed will bear the weight of the machine, additional equipment that may be installed on the machine, and the heaviest workpiece that will be used. Additionally, consider the weight of the operator and any dynamic loading that may occur when operating the machine.

Space Allocation

Consider the largest size of workpiece that will be processed through this machine and provide enough space around the machine for adequate operator material handling or the installation of auxiliary equipment. With permanent installations, leave enough space around the machine to open or remove doors/covers as required by the maintenance and service described in this manual. **See below for required space allocation.**

Physical Environment

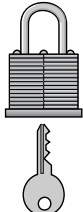
The physical environment where the machine is operated is important for safe operation and longevity of machine components. For best results, operate this machine in a dry environment that is free from excessive moisture, hazardous chemicals, airborne abrasives, or extreme conditions. Extreme conditions for this type of machinery are generally those where the ambient temperature range exceeds 41°–104°F; the relative humidity range exceeds 20%–95% (non-condensing); or the environment is subject to vibration, shocks, or bumps.

Electrical Installation

Place this machine near an existing power source. Make sure all power cords are protected from traffic, material handling, moisture, chemicals, or other hazards. Make sure to leave enough space around machine to disconnect power supply or apply a lockout/tagout device, if required.

Lighting

Lighting around the machine must be adequate enough that operations can be performed safely. Shadows, glare, or strobe effects that may distract or impede the operator must be eliminated.

	<p>CAUTION</p> <p>Children or untrained people may be seriously injured by this machine. Only install in an access restricted location.</p>
-------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------

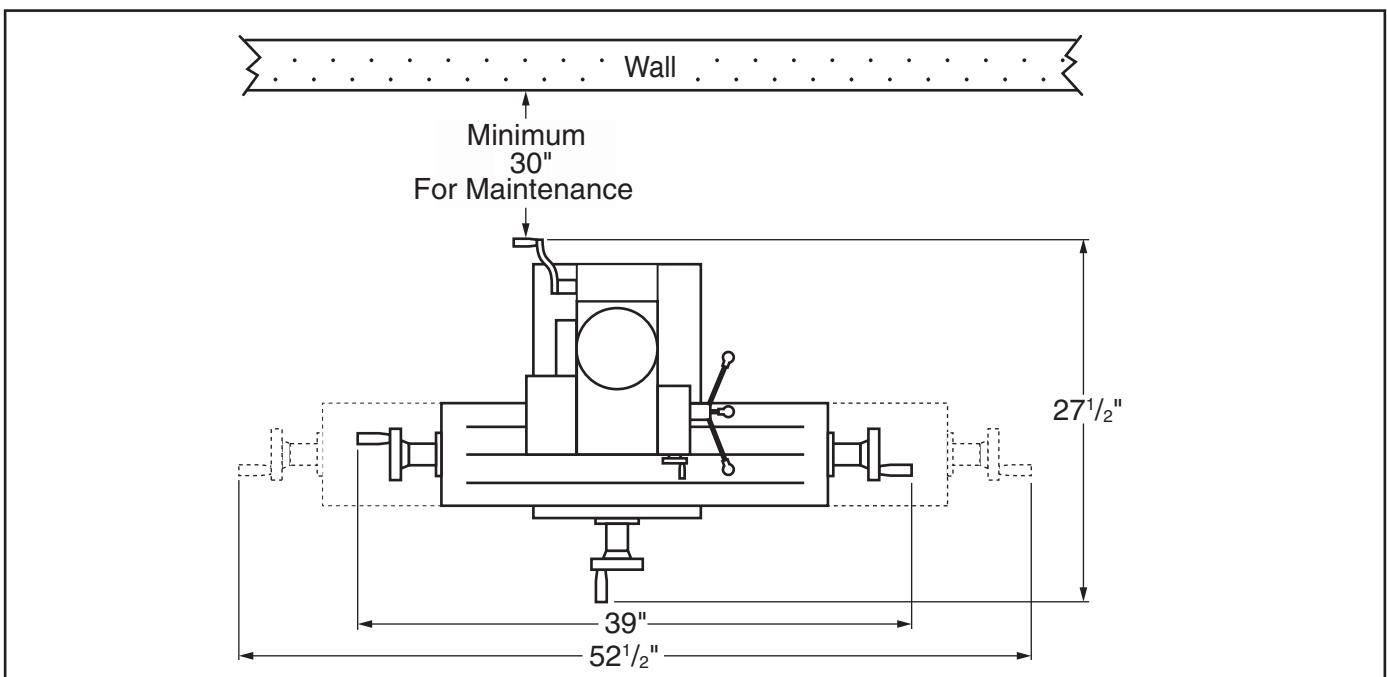
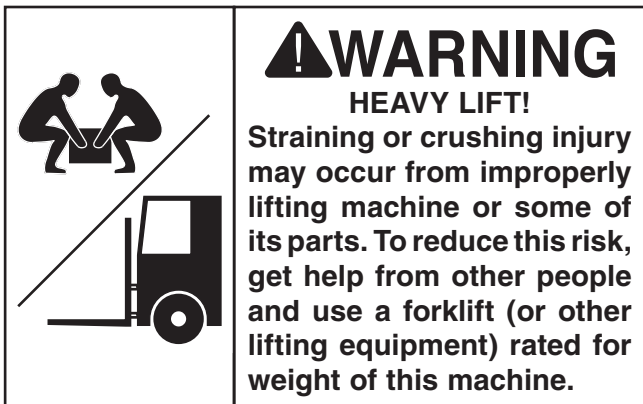


Figure 6. Minimum working clearances.



Lifting & Placing



To lift and place machine into position:

1. Move shipping crate next to workbench or stand, then unbolt machine from pallet.
2. Move machine work table as close to column as possible, and raise headstock to its highest position. This will help balance machine when moving.
3. Tighten Z-Axis and table locks (see **Page 3**) to avoid sudden shifts when lifting.
4. Position a lifting sling under headstock, as shown in **Figure 7**. Connect sling ends to a forklift, then place machine on workbench.

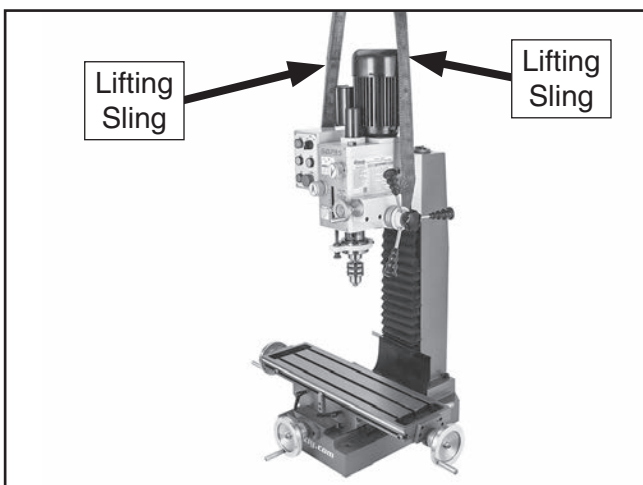


Figure 7. Recommended lifting sling position around headstock.

5. Secure machine to workbench following instructions in **Bench Mounting**.

Bench Mounting

Number of Mounting Holes 4
 Diameter of Mounting Hardware..... 1/2"

The base of this machine has mounting holes that allow it to be fastened to a workbench or other mounting surface to prevent it from moving during operation and causing accidental injury or damage.

The strongest mounting option is a "Through Mount" (see example below) where holes are drilled all the way through the workbench—and hex bolts, washers, and hex nuts are used to secure the machine in place.

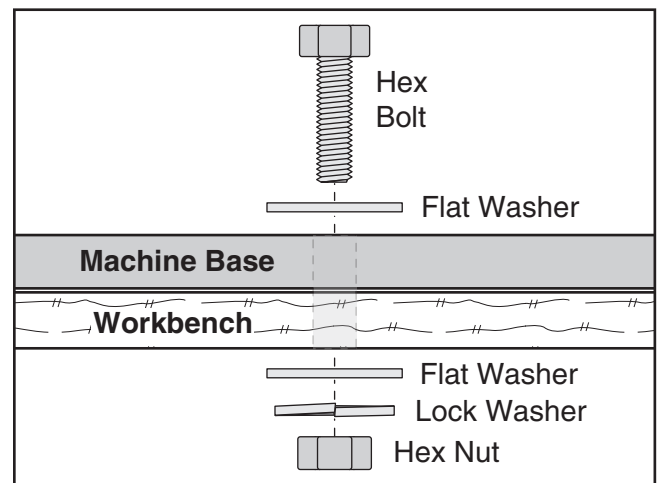


Figure 8. Example of a "Through Mount" setup.

Another option is a "direct mount" (see example below) where the machine is secured directly to the workbench with lag screws and washers.

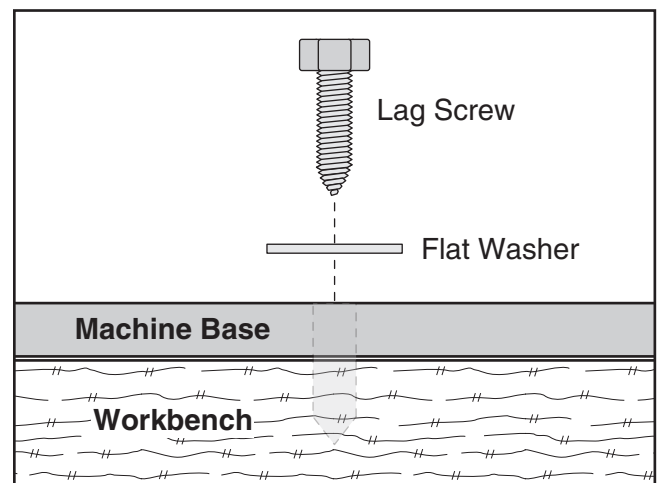


Figure 9. Example of a "Direct Mount" setup.



Assembly

The mill/drill was fully assembled at the factory except for the handwheel handles.

Use a flathead screwdriver to attach the handwheels handles, as shown in **Figure 10**.

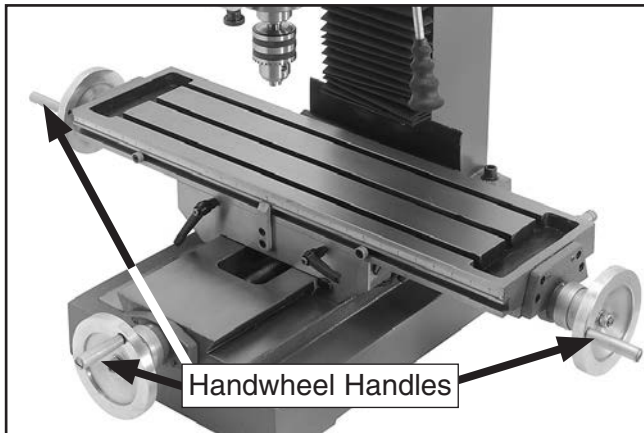


Figure 10. Handwheel handles attached.

Joining Drill Chuck & Arbor

An arbor is included for the drill chuck that comes with this machine. The following procedure describes how to install the arbor in the chuck.

After the arbor is installed in the drill chuck, it is very difficult to separate the assembly. If you would like to use a different chuck in the future, we recommend obtaining a new arbor.

IMPORTANT: DO NOT install the drill chuck and arbor assembly into the spindle until **AFTER** the test run.

To join drill chuck and arbor:

1. Use acetone or lacquer thinner to clean drill chuck and arbor mating surfaces, especially the bore.
2. Retract chuck jaws completely into chuck.
3. Insert small end of arbor into chuck.
4. Hold assembly by the arbor and tap chuck onto a block of wood with medium force, as illustrated below.

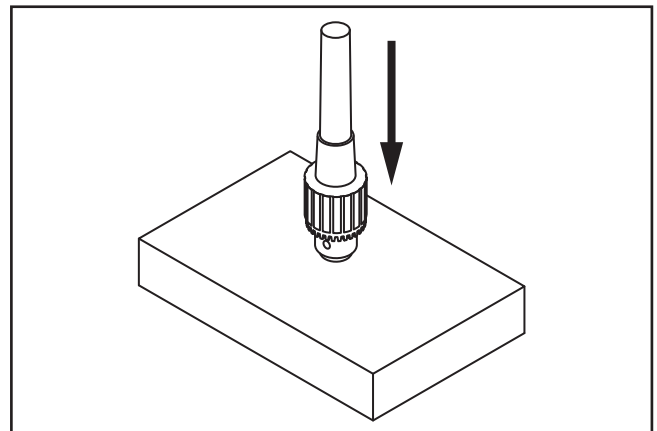


Figure 11. Tapping drill chuck/arbor on block of wood.

5. Attempt to separate drill chuck and arbor by hand—if they separate, repeat **Steps 3–4**.



Lubricating Mill/Drill



The headstock oil reservoir must have the proper amount of oil in it before the mill/drill can be operated for the first time.

Damage caused by running the mill/drill without oil in the reservoir will not be covered under warranty. Refer to the **Lubrication** subsection, beginning on **Page 34**, for details on how to check and add oil.

WARNING

Serious injury or death can result from using this machine **BEFORE** understanding its controls and related safety information. **DO NOT** operate, or allow others to operate, machine until the information is understood.

WARNING

DO NOT start machine until all preceding setup instructions have been performed. Operating an improperly set up machine may result in malfunction or unexpected results that can lead to serious injury, death, or machine/property damage.

Test Run

Once assembly is complete, test run the machine to ensure it is properly connected to power and safety components are functioning correctly.

If you find an unusual problem during the test run, immediately stop the machine, disconnect it from power, and fix the problem **BEFORE** operating the machine again. The **Troubleshooting** table in the **SERVICE** section of this manual can help.

The test run consists of the following: 1) the motor powers up and runs correctly, 2) the E-Stop button safety feature works correctly, and 3) the tapping controls work correctly.

To test run mill/drill:

1. Clear all setup tools away from machine.
2. Press E-Stop button (see **Figure 12**). This will help prevent unexpected startup when machine is connected to power.
3. Connect machine to power supply, and press Power button (see **Figure 12**). Power indicator light should turn **ON**.

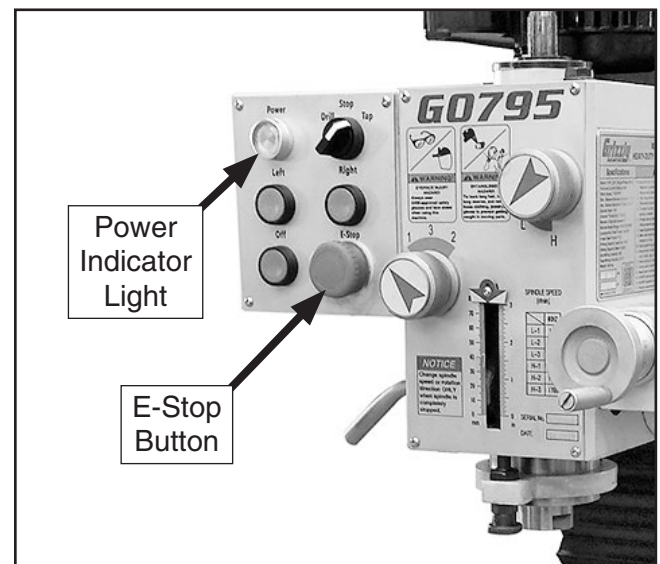


Figure 12. Location of power indicator light and E-Stop button.

4. Rotate mode switch to "**Drill**".



- Turn high/low range knob to "L" and spindle speed knob to "2" (see **Figure 13**). This selects a spindle speed of 220 RPM (refer to spindle speed chart on headstock).

Note: When switching between gears, it may be necessary to rotate spindle by hand so gears will align and engage.

- Twist E-stop button clockwise until it pops out (see **Figure 13**)—this resets the button and enables power to control panel and motor.

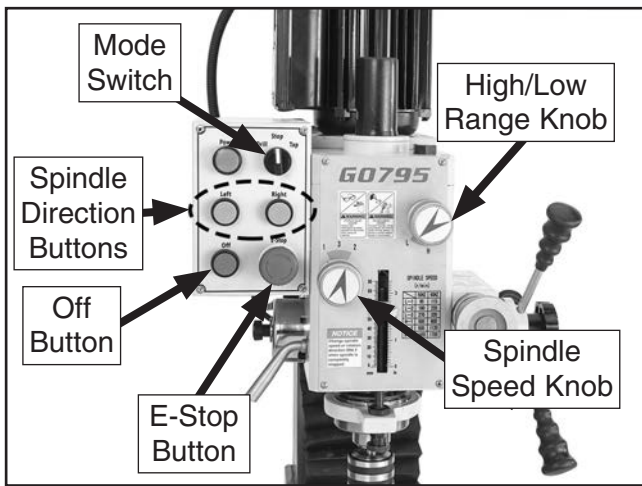


Figure 13. Location of control panel and spindle speed controls.

- Press "Left" button (see **Figure 13**). Spindle should rotate clockwise (as viewed from top) and machine should run smoothly with little to no vibration or rubbing noises.
- Press "Off" button and wait for spindle to completely stop.
- Press "Right" button. Spindle should rotate counterclockwise (as viewed from top).
- Press E-stop button and wait for spindle to completely stop.

- Without resetting E-Stop button, press "Left" button. Machine should *not* start.

—If machine *does* start (with E-Stop button pushed in), immediately disconnect power to machine. E-Stop safety feature is not working correctly. This safety feature must work properly before proceeding with regular operations. Refer to **Troubleshooting** on **Page 38** for help.

- Twist E-Stop button clockwise to reset it.
- Loosen downfeed selector knob slightly, to engage coarse downfeed lever.
- Rotate mode switch to "Tap."
- Press "Left" button. Spindle should rotate clockwise.

Note: Spindle will not engage if "Right" button is pressed while in Tap mode.

- Use coarse downfeed lever to move spindle down. Spindle should rotate clockwise.
- Continue to move spindle down until it reaches bottom of depth stop—spindle should momentarily stop, then rotate counterclockwise.
- Use coarse downfeed lever to move spindle all the way up.

Congratulations! The **Test Run** is complete. Continue to the next subsection, **Spindle Bearing Break-In**.



Spindle Bearing Break-In

The spindle break-in procedure distributes lubrication throughout the bearings to reduce the risk of early bearing failure if there are any "dry" spots or areas where lubrication has settled in the bearings. You **must** complete this procedure **before** placing operational loads on the spindle for the first time when the machine is new or if it has been sitting idle for longer than 6 months.

Always start the spindle break-in at the lowest speed to minimize wear if there *are* dry spots. Allow the spindle to run long enough to warm up and distribute the bearing grease, then incrementally increase spindle speeds and repeat this process at each speed until reaching the maximum spindle speed. Following the break-in procedure in this progressive manner helps minimize any potential wear that could occur before lubrication is fully distributed.

NOTICE

You must complete this procedure to maintain the warranty. Failure to do this could cause rapid wear-and-tear of spindle bearings once they are placed under load.

After completing the spindle break-in procedure, we recommend changing the headstock oil to flush any small particles that may be present in the headstock from the manufacturing process. Refer to the **Lubrication** section on **Page 34** for detailed instructions.

To perform spindle break-in procedure:

1. Set mode switch to Drill.
2. Set spindle speed to 115 RPM (see **Spindle Speed** on **Page 26** for details). Run for 10 minutes in each direction of rotation (FWD and REV).

3. Stop spindle. Select the next highest speed and run spindle for a minimum of 5 minutes in each direction of rotation.
4. Repeat **Step 3** for each remaining speed, working from lowest to highest. The **Spindle Bearing Break-In** is now complete!

Inspections & Adjustments

The following adjustments were performed at the factory before the machine was shipped:

- Gib Adjustments **Page 40**
- Leadscrew Backlash **Page 40**
- Return Spring Tension..... **Page 41**

Please be aware that these adjustments can change during the shipping process. Pay careful attention to these adjustments when first operating the machine. If you find that adjustments are not set to your personal preference, re-adjust them.



SECTION 4: OPERATIONS

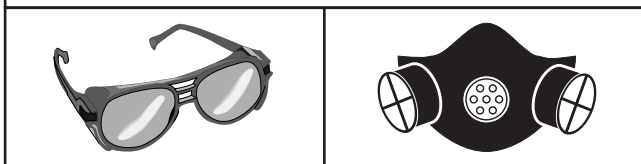
Operation Overview

The purpose of this overview is to provide the novice machine operator with a basic understanding of how the machine is used during operation, so the machine controls/components discussed later in this manual are easier to understand.

Due to the generic nature of this overview, it is **not** intended to be an instructional guide. To learn more about specific operations, read this entire manual, seek additional training from experienced machine operators, and do additional research outside of this manual by reading "how-to" books, trade magazines, or websites.

	<p>!WARNING To reduce your risk of serious injury, read this entire manual BEFORE using machine.</p>
------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------

<p>!WARNING To reduce risk of eye injury from flying chips or lung damage from breathing dust, always wear safety glasses and a respirator when operating this machine.</p>



<p>NOTICE If you are not experienced with this type of machine, WE STRONGLY RECOMMEND that you seek additional training outside of this manual. Read books/magazines or get formal training before beginning any projects. Regardless of the content in this section, Grizzly Industrial will not be held liable for accidents caused by lack of training.</p>

To complete a typical operation, the operator does the following:

1. Examines workpiece to make sure it is suitable for milling and drilling.
2. Securely clamps workpiece to table.
3. With machine disconnected from power, installs correct cutting tool.
4. Adjusts headstock height above table.
5. Selects correct spindle speed and gear setting on gearbox.
6. Connects machine to power and turns it **ON**.
7. Puts on required safety glasses and face shield.
8. Uses downfeed controls or table controls to perform cutting operation.
9. Turns machine **OFF** and waits for spindle to completely stop before removing workpiece, changing tooling, or changing spindle speeds.
10. Disconnects machine from power.



Using Spindle Downfeed Controls

The Model G0795 is equipped with coarse and fine spindle downfeed controls as shown in **Figure 14**. Coarse downfeed is typically used with drilling operations, and fine downfeed is typically used with milling operations.

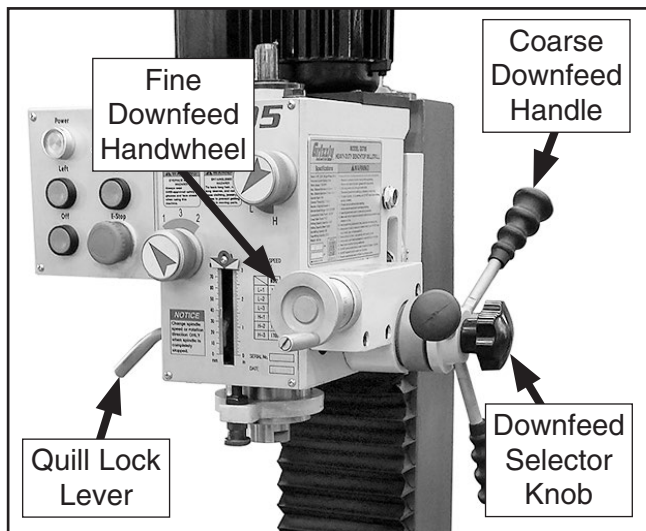


Figure 14. Spindle controls.

Coarse Downfeed

When coarse downfeed is engaged, pull handles downward to lower the spindle. An internal coil spring will raise the spindle back up when you stop applying downward pressure on the handle.

Note: *To maintain control of the upward spindle travel and the rotating bit in your workpiece, always continue holding the handle until the spindle returns to the top position. Letting go of the coarse downfeed handles when the spindle is in the lowered position will cause the spindle to retract too quickly and slam up into the headstock or lift the workpiece and cause it to spin out of control.*

Fine Downfeed

To engage the fine downfeed, turn the downfeed selector knob clockwise until tightened. When fine downfeed is engaged, the spindle only moves up or down when the handwheel is rotated (there is no automatic spindle return to the top position, as with the coarse downfeed controls). This manual level of control makes it easy to precisely lock the spindle height in place with the quill lock lever when milling a flat surface across the face of a workpiece, to ensure the spindle height does not move until the entire milling operation is complete.

The graduated dial measures spindle movement in 0.001" increments, with one full revolution equaling 0.080" of spindle travel.

Using Fine Downfeed Controls

The fine downfeed handwheel allows for a precise amount of material to be removed from the workpiece.

In the following example, the fine downfeed controls are used to mill 0.010" off a workpiece:

1. Use headstock elevation crank (see **Figure 16** on next page) to adjust cutting tool just above workpiece surface, then secure the headstock with Z-axis lock levers.
2. Tighten downfeed selector knob (see **Figure 14**) to engage fine downfeed handwheel.
3. Loosen quill lock lever.
4. Rotate fine downfeed handwheel clockwise and lower cutting tool so it just touches workpiece.
5. Move workpiece out of the way.
6. Using graduated dial to gauge spindle movement, rotate fine downfeed handwheel clockwise 0.010".
7. Tighten quill lock lever.
8. Turn mill/drill **ON** and perform cutting pass.



Setting Depth Stop

The depth stop limits the downward movement of the cutting tool when drilling or tapping the same size hole in multiple workpieces. The depth stop adjustment knob is used to position the depth stop for holes up to 3½" deep. A pointer attached to the depth stop is provided in front of the depth scale to help you set the approximate hole depth, but the scale depth can only be relied on if the spindle height is first positioned so the bottom of the drill of tap is just above the top of the workpiece.

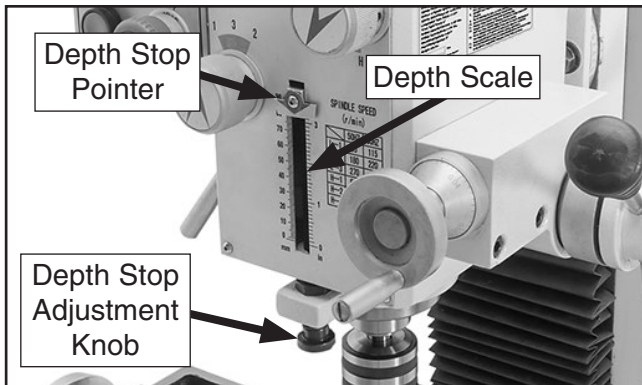


Figure 15. Depth stop pointer and adjustment knob.

To set the depth stop:

1. DISCONNECT MACHINE FROM POWER!
2. Install tooling into chuck, then make sure spindle is completely raised up into headstock.
3. Place a thin piece of sheet stock or other material over workpiece. This will be used as a calibration tool in the next step.
4. Unlock headstock elevation lock levers and use headstock elevation crank to position cutting tool until it lightly touches the sheet stock (or other material) used in the previous step. Remove cardboard and retighten lock levers.

5. Adjust the depth stop pointer to the "0" mark on the scale to calibrate it to the workpiece, then remove the sheet stock and tighten the headstock elevation lock levers.
6. Rotate depth stop adjustment knob until the depth stop pointer reaches the desired drilling depth as indicated by the scale.

Note: *The depth scale functions as a general guide only.*

Adjusting Headstock

The headstock can be adjusted up and down the column (Z-axis) and tilted 45° left or right relative to the table. A scale is provided to indicate the tilting angle of the headstock. However, this should be used as a general guide—not relied on for precision operations. Refer to the section on "Tramming the Headstock" for additional details on precisely positioning the head at 0°.

Adjusting Headstock Height

1. DISCONNECT MACHINE FROM POWER!
2. Loosen both lock levers shown in **Figure 16**.
3. Use headstock elevation crank shown in **Figure 16** to adjust headstock height.

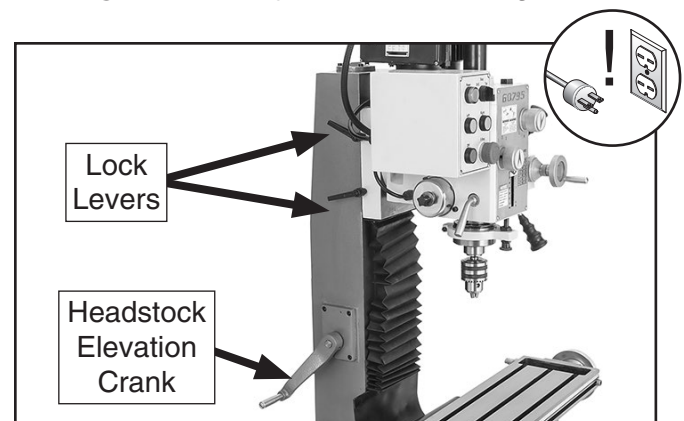


Figure 16. Location of headstock elevation controls.

4. Tighten lock levers to secure setting.



Tilting Headstock

1. DISCONNECT MACHINE FROM POWER!
2. Loosen the three hex nuts (see **Figures 17–18**) that lock headstock tilt in position.

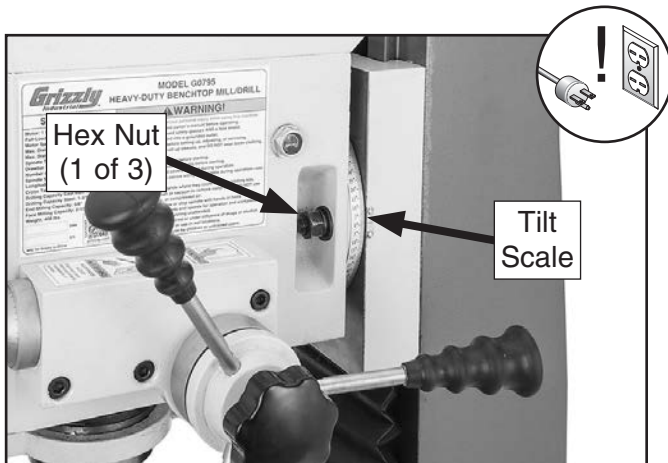


Figure 17. Hex nut (one on each side of headstock).

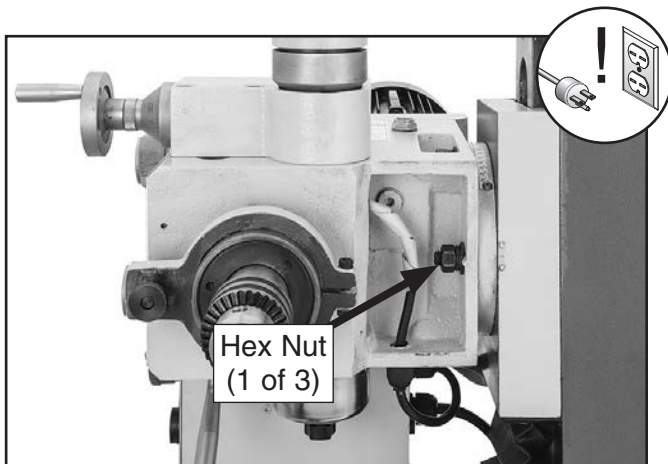


Figure 18. Hex nut underneath headstock (headstock tilted 90° for clarity).

3. Using tilt scale shown in **Figure 17** as a guide, push or pull headstock to swivel it into desired position, then retighten the three hex nuts to secure it.

Controlling Table Travel

The table travels in two directions and is controlled by handwheels, as illustrated in **Figure 19**:

- X-axis (longitudinal)
- Y-axis (cross)

Both the X- and Y-axis feature table locks. To ensure unexpected movement of the table does not occur during precision operations, use these locks to secure the table along any axis that should not move for any given operation.

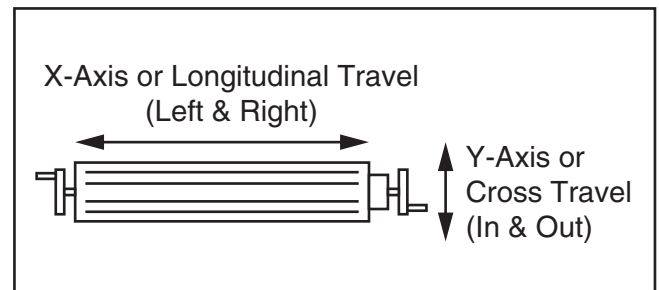


Figure 19. Directions of table movement.

The table handwheels have graduated dials (see **Figure 20**) in 0.001" increments, with one full revolution equalling 0.10". These dials provide an easy way to gauge precise table movements while milling.

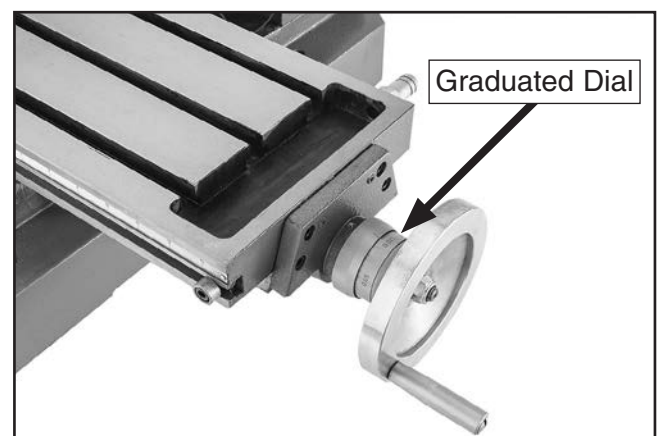


Figure 20. Graduated dial on table handwheel.

Continued on next page →



This machine is equipped with adjustable limit stops (see **Figure 21**) on each end of the table and a stop block in the center. The limit stops can be secured anywhere along the table so they make contact with the stop block to limit table travel along the X-axis. This feature is typically used when milling up to a shoulder.

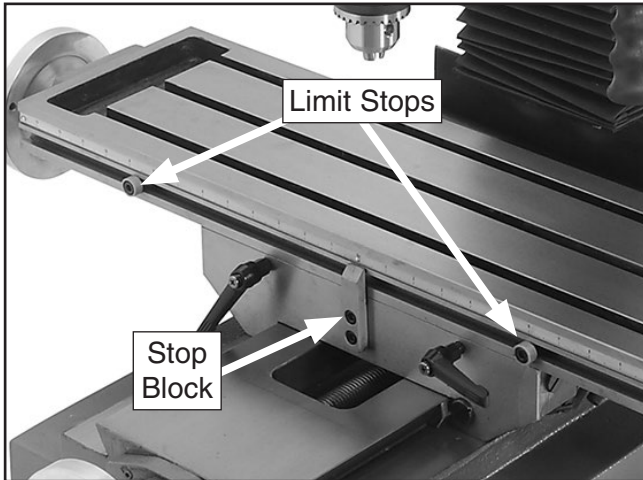


Figure 21. Limit stops and stop block for limiting table movement.

Installing/Removing Tooling

The Model G0795 includes a 3–16mm drill chuck with an R-8 arbor (see **Figure 22**). The R-8 arbor is precision-ground, and features a tool slot for easy, secure alignment in the mill/drill spindle. The tapered R-8 arbor end joins securely with the drill chuck to support tooling from 3–16mm.

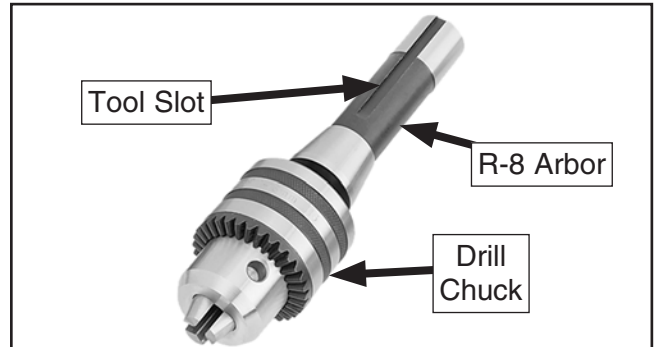


Figure 22. Drill chuck joined with R-8 arbor.

⚠ CAUTION
Cutting tools are sharp and can easily cause laceration injuries. Always protect your hands with leather gloves or shop rags when handling cutting tools.

Installing Tooling

Tools Needed	Qty
Wrench 16mm	1
Spindle Wrench.....	1

To install tooling:

1. DISCONNECT MACHINE FROM POWER!
2. Remove drawbar cap, as shown in **Figure 23**.



3. Install drawbar (see **Figure 4** on **Page 12**).
4. Position tool alignment slot (see **Page 24**) with pin inside spindle, then insert tooling into spindle until it contacts drawbar.
5. Working from top end, thread drawbar by hand into tooling until snug.
6. Place 16mm wrench over drawbar, then use spindle wrench on spindle flats (see **Figure 23**) to keep spindle from rotating.

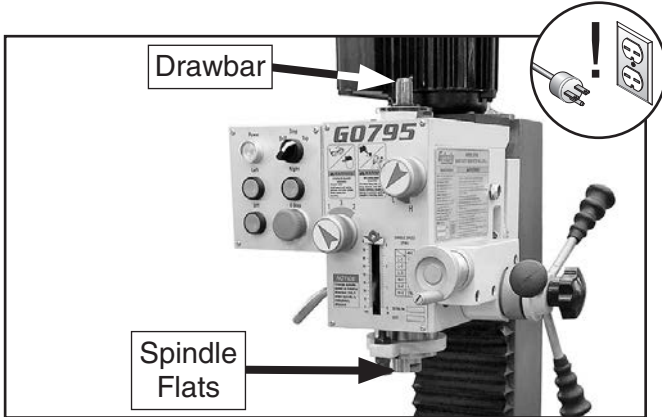


Figure 23. Location of spindle flats and drawbar.

7. Tighten drawbar and re-install drawbar cap.

NOTICE

Do not overtighten drawbar. Overtightening makes tool removal difficult and may damage arbor and threads.

Removing Tooling

Tools Needed	Qty
Wrench 16mm	1
Spindle Wrench	1
Brass Head or Dead Blow Hammer	1

To remove tooling:

1. **DISCONNECT MACHINE FROM POWER!**
2. Remove drawbar cap.
3. Place spindle wrench over spindle flats to keep the spindle from rotating, and use 16mm wrench to loosen drawbar one full rotation.

Note: *Do not fully unthread tooling from drawbar or the drawbar and tool threads could be damaged in the next step.*

4. Tap top of drawbar with hammer to unseat taper.
5. Hold onto tooling with one hand and fully unthread drawbar with the other hand.



Setting Spindle Speed

Using the correct spindle speed is important for safe and satisfactory results, as well as maximizing tool life.

To set the spindle speed for your operation, you will need to (1) determine the best spindle speed for the cutting task, and (2) configure the spindle speed levers to produce the required speed.

Determining Spindle Speed

Many variables affect the optimum spindle speed to use for any given operation, but the two most important are the recommended cutting speed for the workpiece material and the diameter of the cutting tool, as noted in the formula shown in **Figure 24**.

$\frac{\text{*Recommended Cutting Speed (FPM)} \times 12}{\text{Tool Dia. (in inches)} \times 3.14} = \text{Spindle Speed (RPM)}$ <p>*Double if using carbide cutting tool</p>

Figure 24. Spindle speed formula for mill/drills.

Cutting speed, typically defined in feet per minute (FPM), is the speed at which the edge of a tool moves across the material surface.

A recommended cutting speed is an ideal speed for cutting a type of material in order to produce the desired finish and optimize tool life.

The books **Machinery's Handbook** or **Machine Shop Practice**, and some internet sites, provide excellent recommendations for which cutting speeds to use when calculating the spindle speed. These sources also provide a wealth of additional information about the variables that affect cutting speed and they are a good educational resource.

Also, there are a large number of easy-to-use spindle speed calculators that can be found on the internet. These sources will help you take into account the applicable variables in order to determine the best spindle speed for the operation.

Setting Spindle Speed

Use the chart below or the one on the headstock when setting the spindle speed. With the spindle completely stopped, position the high/low range and spindle speed knobs as indicated by the spindle speed chart (see **Figure 25**) to set the desired spindle RPM.

Note: If necessary, rotate the spindle a little by hand to mesh the gears when changing speeds.

Spindle Speed	High/Low Range Lever	Spindle Speed Lever
115 RPM	L	1
220 RPM	L	2
320 RPM	L	3
600 RPM	H	1
1120 RPM	H	2
1700 RPM	H	3

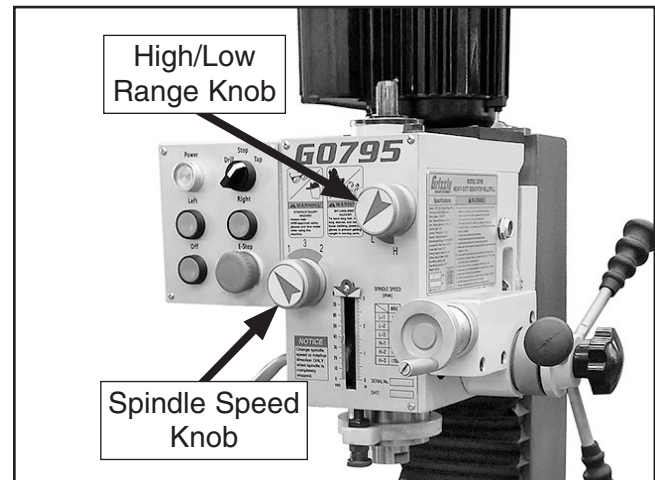


Figure 25. Spindle speed controls.

NOTICE

Change spindle speed ONLY when the spindle is completely stopped. Otherwise, machine damage could occur.



Using Tapping Mode

When the mode switch is set to "**Tap**," the spindle rotates clockwise as the tap is lowered into the predrilled hole in the workpiece. Once the depth stop is reached, the spindle automatically changes directions and rotates counterclockwise to unthread the tap from the hole.

Important: Pilot holes *must* be drilled prior to beginning any tapping operation.

To use the tapping mode:

1. DISCONNECT MACHINE FROM POWER!
2. Clamp workpiece to work table.
3. Install tap.
4. Select spindle speed of 115 RPM (see **Setting Spindle Speed** on **Page 26**, if necessary).
5. Loosen quill lock lever and downfeed selector knob until coarse downfeed handle moves up and down freely.
6. Adjust headstock elevation (if necessary), so tap is just above workpiece.
7. Set depth stop (see **Figure 26**) to workpiece hole depth.

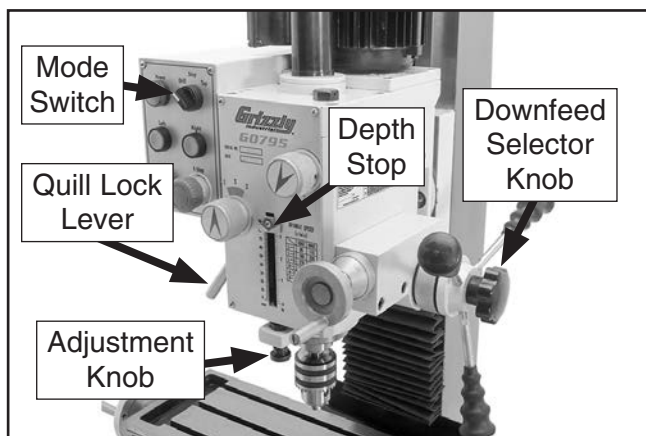


Figure 26. Locations of controls for tapping operation.

8. Apply any appropriate tapping fluid to contact point on workpiece.
9. Connect machine to power.
10. Rotate mode switch to "**Tap**."
11. Press "**Left**" button to engage spindle.
12. Using coarse downfeed handle, slowly lower tap into hole until tap begins threading into workpiece. Release the coarse downfeed handle, allowing tap to travel downward on its own.

Tap will self-thread until the depth stop is reached. When depth stop is reached, spindle rotation will automatically reverse and tap will unthread from hole.
13. Turn machine **OFF**.



SECTION 5: ACCESSORIES

! WARNING

Installing unapproved accessories may cause machine to malfunction, resulting in serious personal injury or machine damage. To reduce this risk, only install accessories recommended for this machine by Grizzly.

NOTICE

Refer to our website or latest catalog for additional recommended accessories.

G7156—4" (3⁵/₈") Precision Milling Vise

G7154—5" (4¹/₂") Precision Milling Vise

G7155—6" (5⁵/₈") Precision Milling Vise

Swiveling Milling Vises feature perfectly aligned, precision ground jaws, large Acme® screws and easy to read 0°–360° scales.

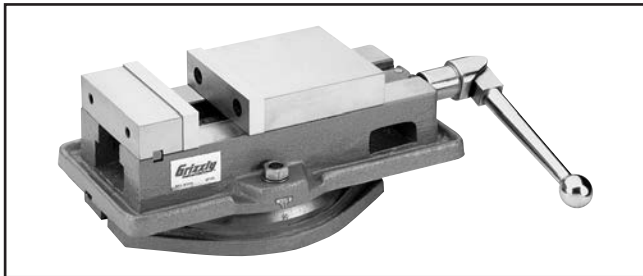


Figure 27. G7154 Precision Milling Vise.

H7576—Precision Self-Centering Vise

Both jaws on this precision vise move in equal and opposite directions so vise remains centered with the milling machine spindle.

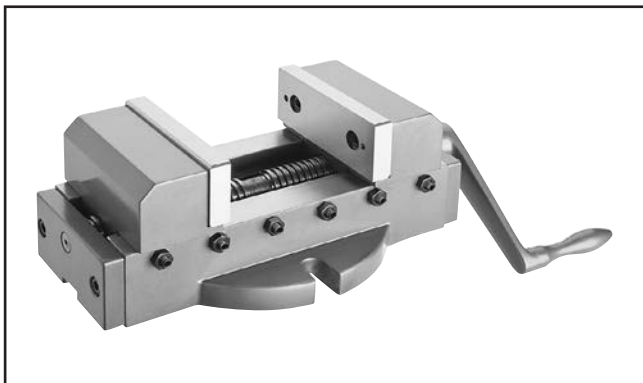


Figure 28. H7576 Specialty Milling Vise.

SB1365—South Bend Lathe Way Oil, 12 Oz.

T23962—ISO 68 Moly-D Machine/Way Oil 5-Gal.

T23963—ISO 32 Moly-D Machine Oil 5-Gal.

T26685—ISO 32 Moly-D Machine Oil, 1-Gal.

Moly-D oils are some of the best we've found for maintaining the critical components of machinery because they tend to resist run-off and maintain their lubricity under a variety of conditions—as well as reduce chatter or slip. Buy in bulk and save with 5-gallon quantities.



Figure 29. 12 oz. way oil & 5 gal. machine oil.

H7617—High-Pressure Oil Can, 5 Oz.

Whether you are lubricating cutting tools or maintaining machinery in top operating condition, you will appreciate this High Pressure Oil Can. Holds 5 ounces of oil, has a trigger-activated, high-pressure pump and a flexible nozzle.



Figure 30. H7617 High Pressure Oil Can.

order online at www.grizzly.com or call 1-800-523-4777



H7527— 6" Rotary Table w/ Div. Plates

Use this 6" rotary table in either the horizontal or vertical position for a variety of milling applications and with the set of dividing plates and adjustable tailstock, your milling applications are nearly unlimited. With 4 degree table movement per handle rotation and 20 second vernier scale, control is very accurate and precise. Also includes a $\frac{3}{8}$ " clamping set for the 4-slot table. Everything you need in one great set!

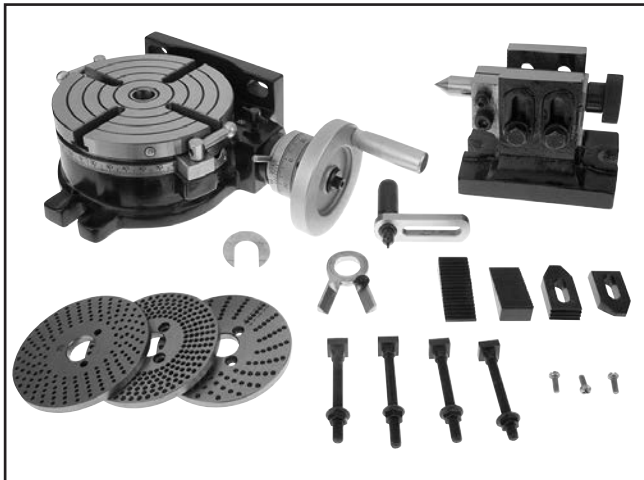


Figure 31. H7527 6" Rotary Table w/Div. Plates.

T26419—Syn-O-Gen Synthetic Grease

Formulated with 100% pure synthesized hydrocarbon basestocks that are compounded with special thickeners and additives to make Syn-O-Gen non-melt, tacky, and water resistant. Extremely low pour point, extremely high temperature oxidation, and thermal stability produce a grease that is unmatched in performance.



Figure 32. T26419 Syn-O-Gen Synthetic Grease.

T26485—58-Pc. Clamping Kit

This clamping kit includes: (24) studs (four studs each: 3", 4", 5", 6", 7", and 8" long), (6) step block pairs, (6) T-nuts, (6) flange nuts, (4) coupling nuts, and (6) end hold-downs. The Model T26485 set fits $\frac{7}{16}$ " T-slots and includes $\frac{3}{8}$ "-16 studs. Racks can be bolted to the wall or side of machine for easy access.



Figure 33. T26485 58-Pc. Clamping Kit.

SB1348—South Bend® 8-Pc. R-8 Collet Set

SB1349—South Bend® 16-Pc. R-8 Collet Set

Get true South Bend® quality and precision with one of these Quick-Change Collet Sets. Each set includes hardened and precision-ground spring collets for maximum holding power, collet chuck, spanner wrench, and protective moulded case.



Figure 34. Model SB1349 South Bend 16-Pc. R-8 Collet Set.

order online at www.grizzly.com or call 1-800-523-4777



G5758—5" x 7" x 3³/₄" Tilt Table

G5759—7" x 10" x 5" Tilt Table

Set your work at any angle from -45° to +45° with these sturdy Tilt Tables. Heavy-duty construction includes 7/16" T-slots, two locking screws, and precision base. 1/2" mounting slots.

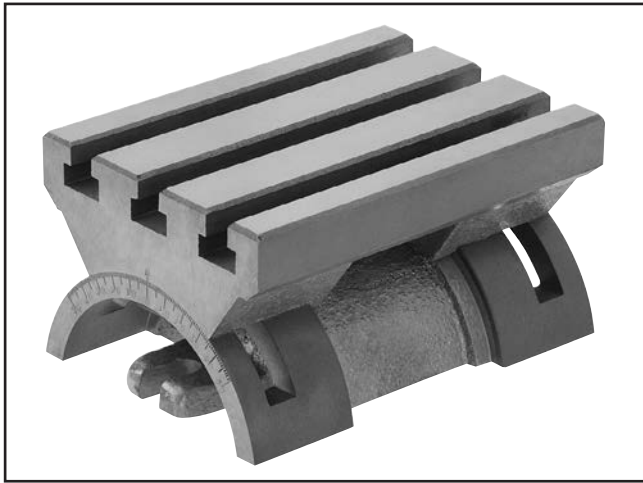


Figure 35. G5758 Tilt Table.

G9806—Dial Indicator 0.05" Range x 0.0001"

If your measuring requirements call for supreme accuracy within a short range, this is the Dial Indicator for you. Graduations are 0.0001" (one ten thousandth of an inch) and range is 0.05" (five hundredths of an inch). Fits all dial indicator magnetic bases.



Figure 36. G9806 Dial Indicator.

T24799—1-2-3 Precision Parallel Blocks

T24800—2-4-6 Precision Parallel Blocks

These blocks are extremely handy for layout and set up work. Matched blocks are hardened and precision ground so all six sides are square to within 0.0003".

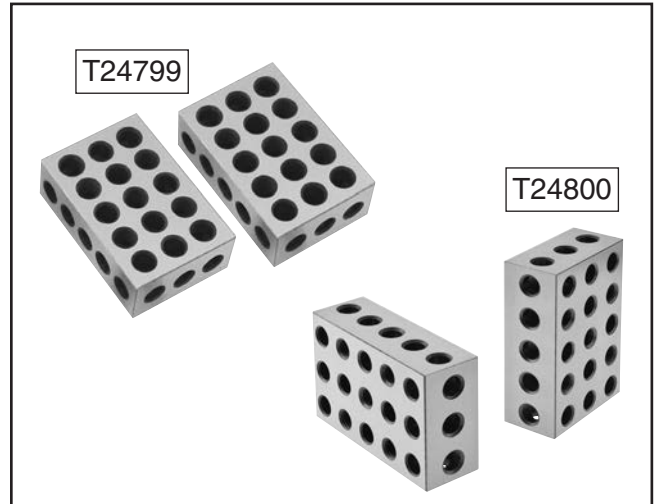


Figure 37. T24799 and T24800 Precision Parallel Blocks.

H5939—Grizzly 18-Pc. R-8 Boring Head Set

This all-inclusive set features a precision 2" boring head, R-8 shank, 9 carbide-tipped boring bars with 1/2" shanks, graduated dial in 0.001"-, 0.05"-, and 0.025" actual motion, and a carrying case.



Figure 38. H5939 2" Boring Head Set.



H5608—V-Block Pair w/Clamps 1⁵/₈"
H5609—V-Block Pair w/Clamps 1³/₄"
H5610—V-Block Pair w/Clamps 2"
H5611—V-Block Pair w/Clamps 2³/₄"
 Each V-Block pair is precision-ground and numbered to match for accuracy.



Figure 39. H5611 V-Block Pair w/Clamps pictured.

T10168—3" Boring Head Set
 This all-inclusive set features a precision 3" boring head, R-8 shank, five-piece set of 3/4" carbide tipped boring bars, five-piece set of 1/2" HSS boring bars, 1/2" to 3/4" adapter, wrenches and fitted case.



Figure 40. T10168 3" Boring Head Set.

G9815—Thin Parallel Set - 10 Pairs
G5646—10-Pc. Precision Angle Block Set
 Speed set-up, production and inspection with the Grizzly Precision Angle Block Set and Thin Parallel Set made from hardened and precision-ground steel. Each set offers a wide range of sizes for any job.

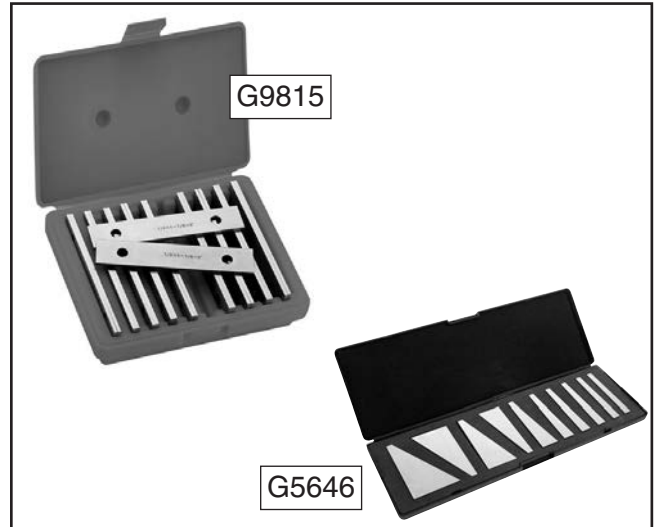


Figure 41. G9815 Thin Parallel Set and G5646 Precision Angle Block Set.

T25702— 5-Pc. R-8 End Mill Holder Set
 This all-inclusive set features a precision 3" boring head, R-8 shank, five-piece set of 3/4" carbide tipped boring bars, five-piece set of 1/2" HSS boring bars, 1/2" to 3/4" adapter, wrenches and fitted case.



Figure 42. T25702 5-Pc. R-8 End Mill Holder Set.



G9756—20-Pc. HSS End Mill Set

This High Speed Steel set features 2 flute and 4 flute end cutting end mills in the following sizes: 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 9/16", 5/8", 11/16" and 3/4". Sizes are marked in a durable molded case.



Figure 43. G9756 20-Pc. HSS End Mill Set.

G9760—20-Pc. 2 & 4 Flute TiN End Mill Set

Includes these sizes and styles in two and four flute styles: 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 9/16", 5/8", 3/8", 11/16", and 3/4".



Figure 44. G9760 20-Pc. End Mill Set.

H5935—3-Pc. Fly Cutter Set w/ 1/2" Tool Bits

Here is a 3-piece Fly Cutter Set that's hard to beat! Each is supplied with black oxide finish, a setscrew flat and a blank high speed steel tool.



Figure 45. H5935 3-Pc. Fly Cutter Set.

Precision Parallel Block

T25212—18-Pc. Tap/Drill Set HSS UNC

T25213—18-Pc. Tap/Drill Set HSS UNF

G9766—29-Pc. HSS Drill & Tap Set - Metric

H5615—Screw Pitch Gauge 4-84

We offer a set of taps with all the drill bits necessary to produce perfectly tapped holes, and help ensure you get your work done right the first time with the Grizzly Screw Pitch Gauge. Our gauge helps determine the thread pitch of a bolt, tapped hole, nut or screw thread insert.

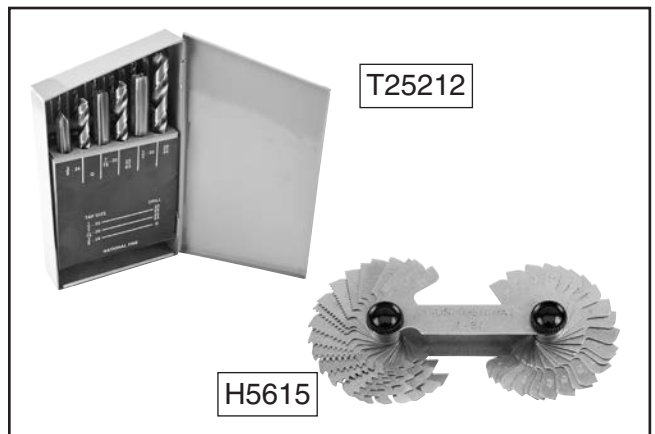
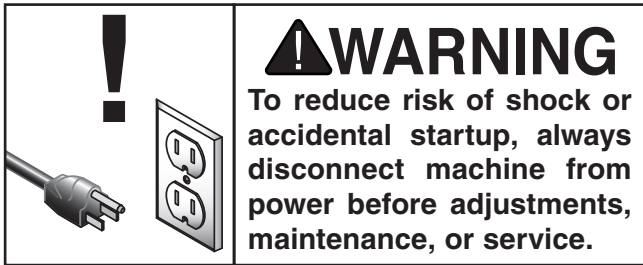


Figure 46. H5615 Screw Pitch gauge and T25212 18-Pc. Tap/Drill Set.



SECTION 6: MAINTENANCE



Schedule

For optimum performance from this machine, this maintenance schedule must be strictly followed.

Ongoing

To maintain a low risk of injury and proper machine operation, if you ever observe any of the items below, shut down the machine immediately and fix the problem before continuing operations:

Daily Check:

- Loose mounting bolts.
- Damaged saw blade.
- Worn or damaged wires.
- Clean debris and built up grime off of machine.
- Any other unsafe condition.

Every 8 Hours of Operation:

- Check/add headstock oil (**Page 34**).
- Lubricate ball oilers (**Page 35**).
- Lubricate table and column ways (**Page 35**).
- Lubricate quill outside surface (**Page 36**).

Every 40 Hours of Operation:

- Lubricate table leadscrews (**Page 36**).

Every 90 Hours of Operation:

- Lubricate column leadscrew, nut, and pinion gear (**Page 37**).
- Lubricate quill rack and pinion (**Page 37**).

Annually:

- Change headstock oil (**Page 34**).

Cleaning & Protecting

Metal chips left on the machine that have been soaked with water-based coolant will invite oxidation and a gummy residue build-up around the moving parts. Use a brush and shop vacuum to remove chips and debris from the working surfaces of the mill/drill. Never blow off the mill/drill with compressed air, as this will force metal chips deep into the mechanisms and may cause injury to yourself or bystanders.

Remove any rust build-up from unpainted cast iron surfaces of your mill/drill and treat with a non-staining lubricant after cleaning.

Keep unpainted cast iron surfaces rust-free with regular applications of ISO 68 way oil (see **Page 28** for offerings from Grizzly).

NOTICE

The recommended lubrication is based on light-to-medium usage. Since lubrication helps to protect value and operation of machine, these lubrication tasks may need to be performed more frequently than recommended, depending on usage.

Failure to follow reasonable lubrication practices as instructed in this manual could lead to premature failure of machine components and will void the warranty.



Lubrication

This mill/drill requires regular lubrication to maintain smooth movement and ensure long-lasting operation. Components not covered in this section are sealed and internally lubricated for life.

Before performing any lubrication task, **DISCONNECT MACHINE FROM POWER!**

Lubrication Frequency

Lubrication Task	Frequency	Page
Ball Oilers	Daily	35
Table Leadscrew	Daily	36
Headstock	Annually	34
Column Nut & Pinion	Annually	37
Quill Outside Surface	Daily	36
Quill Rack & Pinion	Annually	37
Table & Column Ways	Daily	35

Headstock

Lube Type...Model T23962 or ISO 68 Equivalent
 Lube Amount 1 ¼ qt.
 Check/Add Frequency 8 hrs. of Operation
 Change Frequency Annually

The headstock has the proper amount of oil when the sight glass shown in **Figure 47** is halfway full.

NOTICE

Follow federal, state, and local requirements for proper disposal of used oil.

Tools Needed	Qty
Wrench 24mm	1
Hex Wrench 6mm.....	1
Drain Pan (1-Gallon or larger)	1

To change headstock oil:

1. Run spindle at 600 RPM for approximately 10 minutes to warm oil.
2. **DISCONNECT MACHINE FROM POWER!**

3. Remove fill plug (see **Figure 47**).

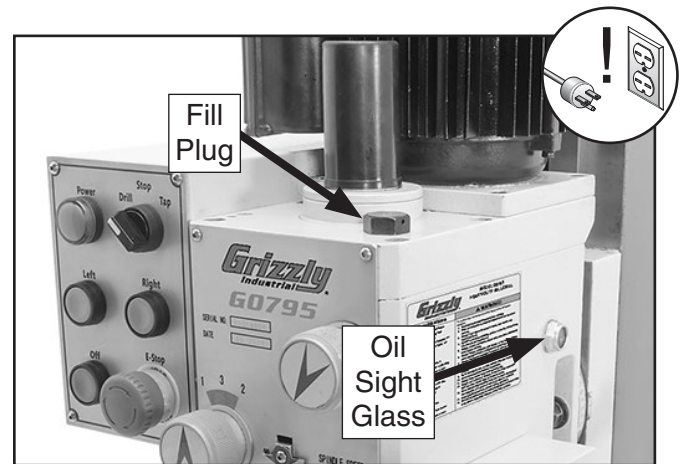


Figure 47. Headstock oil fill plug and sight glass.

4. Place a 1-gallon or larger drain pan on table under headstock.
5. Remove drain plug (see **Figure 48**) and allow oil to drain into pan.

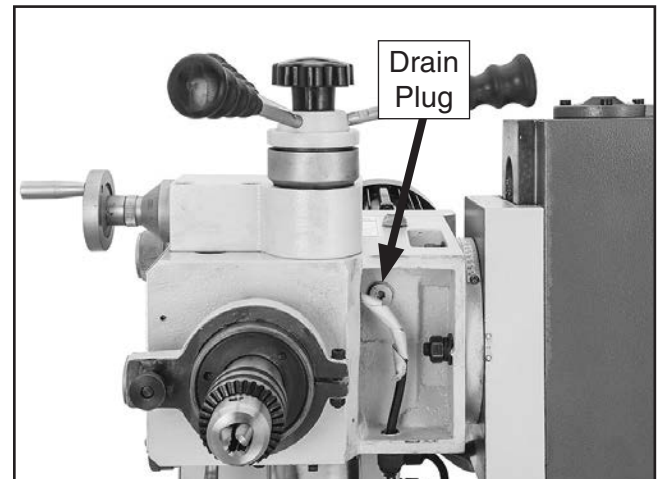


Figure 48. Location of headstock drain plug (headstock tilted 90° for clarity).

6. Replace drain plug.
7. Add oil until sight glass is halfway full, then replace fill plug.
8. Clean up any spilled oil to reduce slipping hazards.



Ball Oilers

Lube Type...Model T23963 or ISO 32 Equivalent
 Lube Amount 1–2 Pumps
 Lubrication Frequency 8 hrs. of Operation

Proper lubrication of the handwheel ball oilers shown in **Figure 49** is done with a pump-type oil can with a tip wide enough to seal the ball oil inlet (see **Page 28** for offerings from Grizzly). We *do not* recommend using metal needle or lance-type tips, as they can push the ball too far into the oiler, break the spring seat, and lodge the ball in the oil galley.

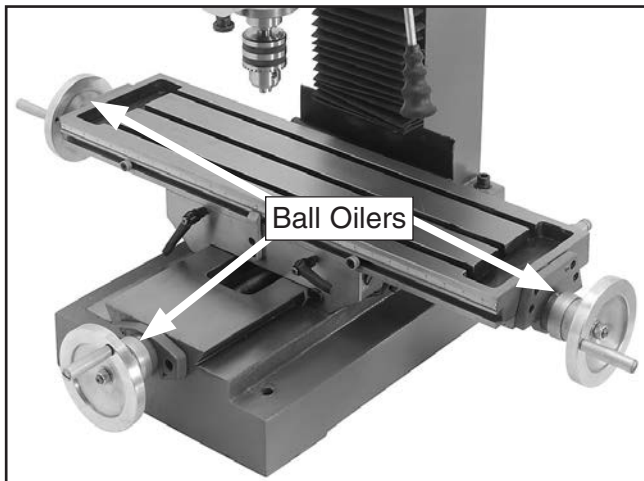


Figure 49. Location of handwheel ball oilers.

To lubricate ball oiler:

1. Push tip of oil can nozzle against ball oiler and pump oil can once or twice.

Note: *If you see sludge and contaminants coming out of the lubrication area, continue pumping oil can until the oil runs clear.*

2. When finished, wipe away any excess oil.

Table & Column Ways

Lube Type...Model T23962 or ISO 68 Equivalent
 Lube Amount Thin Coat
 Lubrication Frequency 8 hrs. of Operation

Tool Needed

Qty

Hex Wrench 5mm..... 1

Disconnect one side of the column way cover, then move the table toward the front of the mill and headstock upward to access the entire length of the table and column ways for this procedure (see **Figures 50–51**).

Note: *Each sliding component has two dovetail ways—one on each side of the component.*

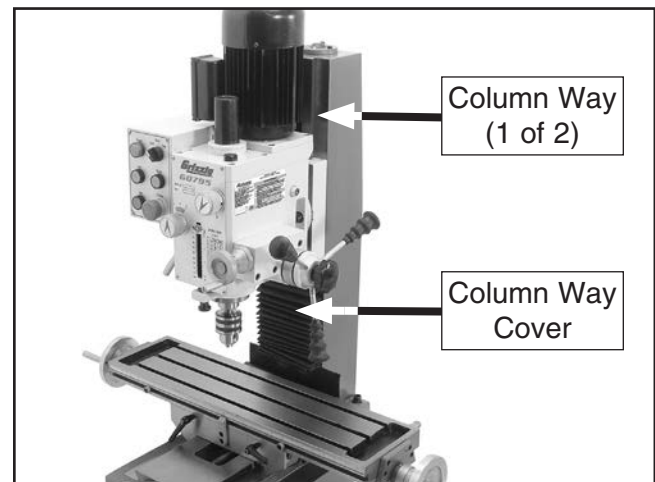


Figure 50. Location of table and column ways.

Clean the ways with mineral spirits and shop rags. When dry, apply a liberal coat of lubricant, then move the sliding components through their full path a few times to evenly distribute the oil. Re-install the column way cover.



Figure 51. X- and Y-axis table ways.



Quill Outside Surface

Lube Type...Model T23962 or ISO 68 Equivalent
 Lube AmountThin Coat
 Lubrication Frequency 8 hrs. of Operation

Without disturbing the grease on the quill rack, clean the outside smooth surface of the quill (see **Figure 52**) with mineral spirits and shop rags.



Figure 52. Outside surface of quill.

When dry, apply a thin coat of lubricant to the smooth surface, then move the spindle up and down to evenly distribute the oil.

Table Leadscrews

Lube Type.....NLGI#2 or ISO 68 Equivalent
 Lube AmountThin Coat
 Lubrication Frequency 40 hrs. of Operation

Tool Needed	Qty
Hex Wrench 5mm.....	1

Move the table as necessary to access the entire length of the X- and Y-axis leadscrews (see **Figures 53–54**). Remove the way cover from the base to access the Y-axis leadscrew. Use mineral spirits, shop rags, and a brush to clean them. When dry, use a clean brush to apply a thin coat of oil to the leadscrew threads, then move the table through the X- and Y-axis paths to distribute the oil.

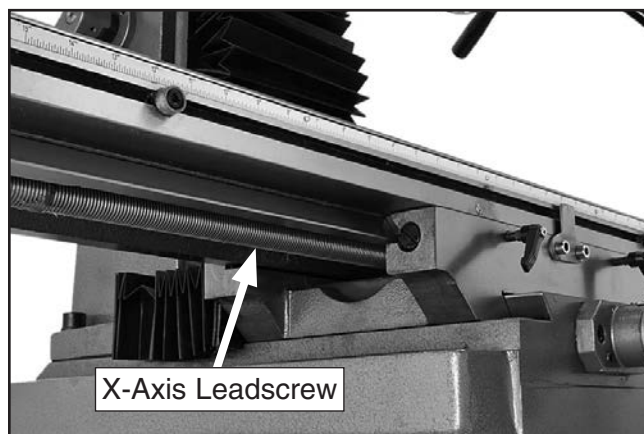


Figure 53. Location of X-axis leadscrew.

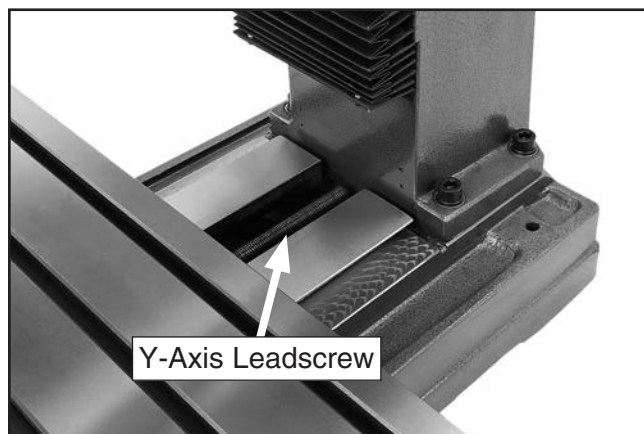


Figure 54. Location of Y-axis leadscrew.



Headstock Elevation Leadscrew & Bevel Gears

Lube Type..Model T23964 or NLGI#2 Equivalent
 Lube AmountThin Coat
 Lubrication Frequency 90 hrs. of Operation

Tool Needed	Qty
Hex Wrench 3mm.....	1

Remove rear cover of the column to access the leadscrew and bevel gears (see **Figure 55**).

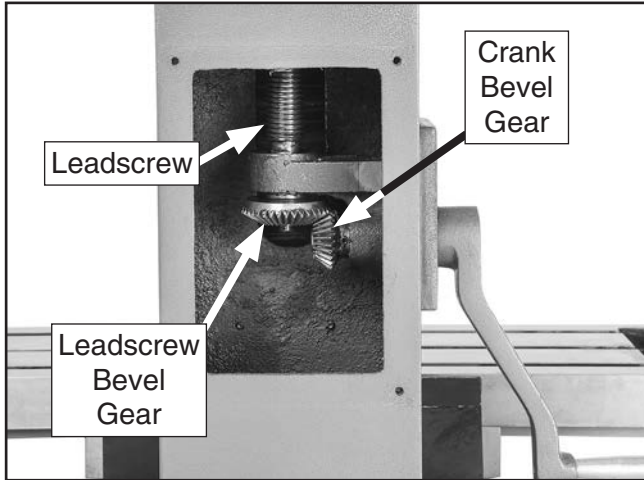


Figure 55. Column rear cover removed to access headstock elevation leadscrew and bevel gears.

Use shop rags, a stiff brush, and mineral spirits to clean away the grease and grime from the components. When dry, apply a medium coat of grease to the components and threads of the leadscrew and gears. Move the headstock up and down a few times to evenly distribute the lubricant. Re-install rear cover.

Quill Rack & Pinion

Lube Type..Model T23964 or NLGI#2 Equivalent
 Lube AmountThin Coat
 Lubrication Frequency 90 hrs. of Operation

Move the quill up and down to gain full access to the quill rack-and-pinion (see **Figure 56**), then clean the teeth with mineral spirits, shop rags, and a brush.

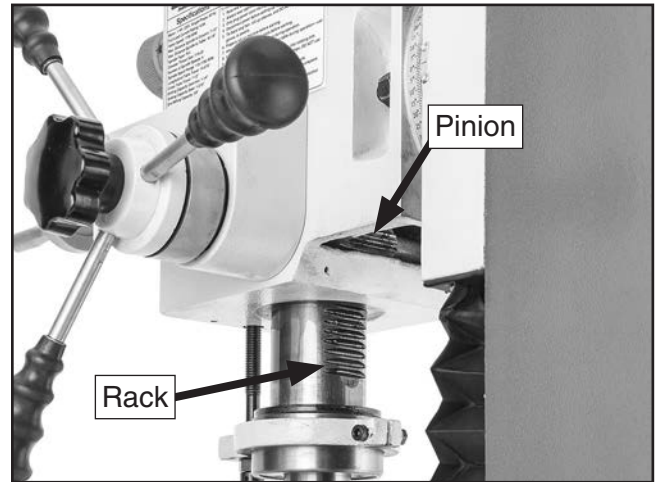


Figure 56. Quill rack-and-pinion.

When dry, use a brush to apply a thin coat of grease to the teeth, then raise/lower the quill several times to evenly distribute the grease.

Note: *Re-apply oil to the quill outside smooth surface that may have been removed during the cleaning process.*



SECTION 7: SERVICE

Review the troubleshooting procedures in this section if a problem develops with your machine. If you need replacement parts or additional help with a procedure, call our Technical Support. **Note:** *Please gather the serial number and manufacture date of your machine before calling.*

Troubleshooting

Motor & Electrical

Symptom	Possible Cause	Possible Solution
Machine does not start or a breaker trips.	<ol style="list-style-type: none"> 1. E-Stop button depressed/at fault. 2. Plug/receptacle at fault/wired wrong. 3. Incorrect power supply voltage or circuit size. 4. Machine fuse blown. 5. Power supply circuit breaker tripped or fuse blown. 6. Motor wires connected incorrectly. 7. Wiring open/has high resistance. 8. ON/OFF switch at fault. 9. Spindle rotation switch at fault. 10. Start capacitor at fault. 11. Centrifugal switch at fault. 12. Motor at fault. 	<ol style="list-style-type: none"> 1. Rotate button head to reset. Replace. 2. Test for good contacts; correct the wiring. 3. Ensure correct power supply voltage and circuit size. 4. Replace fuse/ensure no shorts. 5. Ensure circuit is sized correctly and free of shorts. Reset circuit breaker or replace fuse. 6. Correct motor wiring connections. 7. Check/fix broken, disconnected, or corroded wires. 8. Replace switch. 9. Test/replace switch. 10. Test/replace. 11. Adjust/replace centrifugal switch if available. 12. Test/repair/replace.
Machine stalls or is underpowered.	<ol style="list-style-type: none"> 1. Machine undersized for task. 2. Wrong workpiece material. 3. Motor wired incorrectly. 4. Motor overheated. 5. Run capacitor at fault. 	<ol style="list-style-type: none"> 1. Use correct cutter/bit; reduce feed rate; reduce spindle RPM; use coolant if possible. 2. Use correct type/size of metal. 3. Wire motor correctly. 4. Clean motor, let cool, and reduce workload. 5. Test/repair/replace.
Machine has vibration or noisy operation.	<ol style="list-style-type: none"> 1. Machine incorrectly mounted to workbench or floor. 2. Chuck or cutter at fault. 3. Motor or component loose. 4. Motor fan rubbing on fan cover. 5. Spindle bearings at fault. 6. Centrifugal switch is at fault. 7. Motor bearings at fault. 	<ol style="list-style-type: none"> 1. Adjust feet, shim, or tighten mounting hardware. 2. Replace unbalanced chuck; replace/resharpen cutter; use correct feed rate. 3. Inspect/replace damaged bolts/nuts, and retighten with thread locking fluid. 4. Fix/replace fan cover; replace loose/damaged fan. 5. Test by rotating spindle; rotational grinding/loose shaft requires bearing replacement. 6. Replace. 7. Test by rotating shaft; rotational grinding/loose shaft requires bearing replacement.



Mill/Drill Operation

Symptom	Possible Cause	Possible Solution
Tool slips in spindle.	<ol style="list-style-type: none"> 1. Tool is not fully drawn up into spindle taper. 2. Taking too big of a cut. 3. Debris on tool or in spindle taper. 	<ol style="list-style-type: none"> 1. Tighten drawbar. 2. Lessen depth of cut and allow chips to clear. 3. Clean collet and spindle taper.
Breaking tools or cutters.	<ol style="list-style-type: none"> 1. Spindle speed/feed rate is too fast. 2. Cutting tool too small. 3. Cutting tool getting too hot. 4. Taking too big of a cut. 5. Spindle extended too far down. 	<ol style="list-style-type: none"> 1. Set spindle speed correctly (Page 26) or use slower feed rate. 2. Use larger cutting tool and slower feed rate. 3. Use coolant or oil for appropriate application. 4. Lessen depth of cut and allow chips to clear. 5. Fully retract spindle and lower headstock. This increases rigidity.
Workpiece vibrates or chatters during operation.	<ol style="list-style-type: none"> 1. Table locks not tight. 2. Workpiece not secure. 3. Spindle speed/feed rate is too fast. 4. Spindle extended too far down. 	<ol style="list-style-type: none"> 1. Tighten table locks. 2. Properly clamp workpiece on table or in vise. 3. Set spindle speed correctly (Page 26) or use a slower feed rate. 4. Fully retract spindle and lower headstock. This increases rigidity.
Table is hard to move.	<ol style="list-style-type: none"> 1. Table locks are tightened down. 2. Chips have loaded up on ways. 3. Ways are dry and need lubrication. 4. Table limit stops are interfering. 5. Gibs are too tight. 	<ol style="list-style-type: none"> 1. Make sure table locks are fully released. 2. Frequently clean away chips that load up during milling operations. 3. Lubricate ways (Page 35). 4. Check to make sure that all table limit stops are not in the way. 5. Adjust gibs (see Page 40).
Bad surface finish.	<ol style="list-style-type: none"> 1. Spindle speed/feed rate is too fast. 2. Workpiece not secure. 3. Spindle extended too far down. 4. Dull or incorrect cutting tool. 5. Wrong rotation direction of cutting tool. 	<ol style="list-style-type: none"> 1. Set spindle speed correctly (Page 26) or use a slower feed rate. 2. Properly clamp workpiece on table or in vise. 3. Fully retract spindle and lower headstock. This increases rigidity. 4. Sharpen cutting tool or select one that better suits the operation. 5. Check for proper cutting tool rotation direction.



Adjusting Gibs

The gibs affect the accuracy of the work table by restricting slide movements along their ways.

Screws on each end allow gib adjustments to increase or decrease the friction between the sliding surfaces of the ways.

The goal of gib adjustment is to remove unnecessary sloppiness without causing binding in the dovetail ways. Tight gibs make the movements more accurate, but harder to perform. Loose gibs make the movements sloppy, but easier to perform. Many experienced machinists adjust the gibs until there is just a slight drag in table movement.

DISCONNECT MACHINE FROM POWER BEFORE ADJUSTING THE GIBS!

Make sure all table locks are loose. Then, loosen one gib adjustment screw (see **Figure 57**) and tighten the opposing screw the same amount to move the gib, while at the same time using the handwheels to move the table until you feel a slight drag in that path of movement.

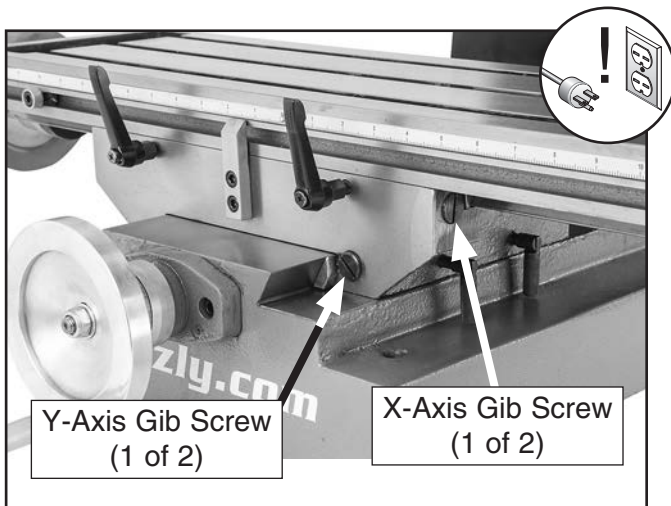


Figure 57. Location of table gib screws.

Adjusting Leadscrew Backlash

Tool Needed	Qty
Hex Wrench 4mm (long).....	1

Leadscrew backlash is the amount of free-play movement in the leadscrew (when changing the direction of rotation) before the attached device begins to move.

Leadscrews must have a certain amount of backlash, but over time, this will increase with normal wear. Generally, 0.003"–0.006" leadscrew backlash is acceptable to ensure smooth movement and reduce the risk of premature thread wear.

The X- and Y-axis leadscrew backlash is adjusted by using a long hex wrench to tighten/loosen the cap screw on the leadscrew nut. This adjusts the force that the split leadscrew nut exerts on the leadscrew threads.

The X-axis leadscrew nut shown in **Figure 58** is accessed from underneath the left side of the table.

The Y-axis leadscrew nut is similar and is accessed from underneath the machine base.

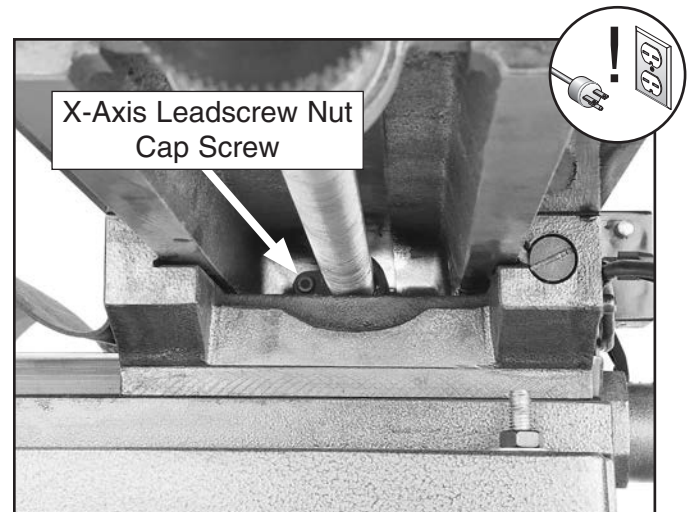


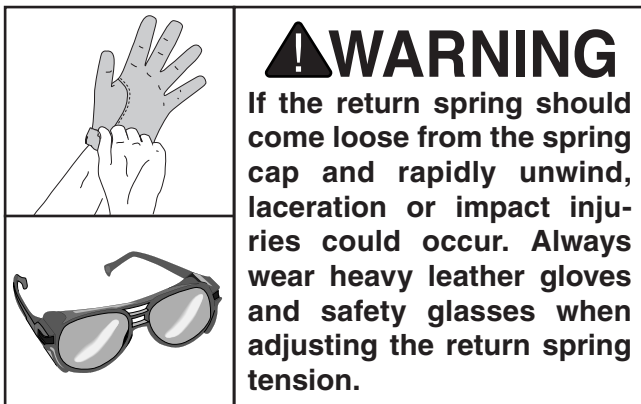
Figure 58. X-axis leadscrew nut adjusting cap screw.



Tightening Return Spring Tension

The return spring moves the spindle back up when the coarse downfeed handles are released. The tension of this spring was adjusted at the factory, but it may need to be tightened during the life of the mill/drill.

IMPORTANT: Do not perform this procedure unless it is absolutely necessary. The high amount of spring tension involved can make this a difficult procedure. Return spring tension is adjusted at the factory and should be suitable for most applications.



During this procedure, you will loosen the spring cover thumb screw (see **Figure 59**) just enough to pull the cover back to clear the roll pin, then rotate the cover clockwise to fit the roll pin in the next slot.

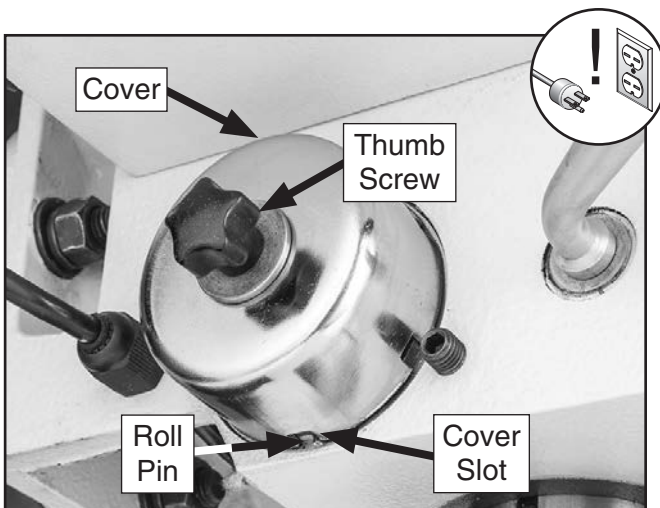


Figure 59. Return spring components.

To adjust the return spring tension:

1. DISCONNECT MACHINE FROM POWER!
2. Wipe off any oil on spring cover so it does not slip when you hold it during adjustments.
3. Mark slot on cover that engages roll pin—this is the factory setting.
4. Put on heavy leather gloves to protect your hands from lacerations if spring uncoils during next step.
Note: Keep a good grip on spring cover during next step. Letting go of cover when roll pin is not engaged will cause spring to rapidly uncoil.
5. While holding spring cover against side of headstock so spring will not unwind, loosen thumb screw approximately 1/4".
6. Pull cover out just enough to disengage it with roll pin, then rotate it clockwise to engage roll pin in next slot in cover.
7. Retighten thumb screw to secure setting.



Tramming Spindle

After positioning the head at an angle and when your operation requires that the spindle axis be precisely perpendicular to the table, you must tram or align the spindle with the table to ensure the spindle is exactly 90° to the table.

This procedure involves mounting a dial test indicator to the quill or spindle, rotating it around the table, and adjusting the spindle axis (Z-axis) 90° to the table X- and Y-axis, as illustrated in **Figure 60**.

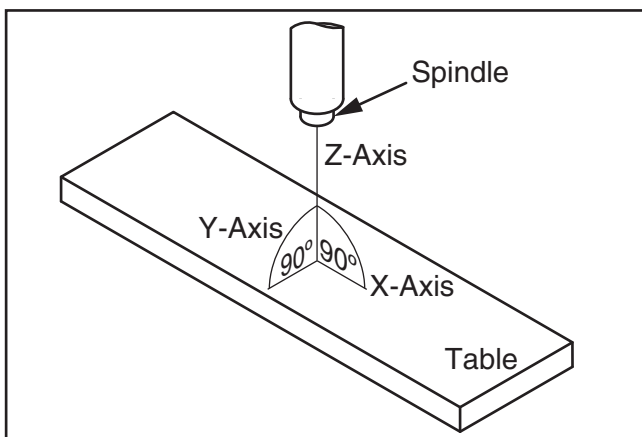


Figure 60. Spindle Z-axis perpendicular to the table X- and Y-axis.

We encourage you to research the many variations of spindle tramming to find the one that works best for you. If you do not already have a preference for performing this operation, use the following widely-used procedure for accurately tramming the spindle to the table.

Keep in mind that all workpiece top surfaces are not exactly parallel with the table top. You may choose to tram the spindle to the top surface of the workpiece after it is mounted rather than tramming the spindle to the table.

Tools Needed	Qty
Dial Test Indicator (with at least 0.0005" resolution)	1
Indicator Holder (mounted on the quill/spindle)	1
Precision Parallel Block (at least 9" in length).....	1

Note: A precision-ground plate can be substituted for the parallel blocks. Keep in mind that the farther the indicator point can be placed from the spindle axis, the more accurate the alignment measurements will be.

To tram spindle to table:

1. DISCONNECT MACHINE FROM POWER!
2. Prepare mill for tramming by performing following tasks:
 - Verify the table is clean by running your hand over the top of it. If necessary, stone the table to remove all nicks and burrs, then clean off all debris.
 - Position the table for the milling operation you intend to perform after tramming—preferably centered with the saddle.
 - Tighten the quill lock lever used during intended milling operations.
3. Place parallel block underneath spindle.
4. Install indicator holder in spindle or on quill, then mount indicator so that point is as parallel to block as possible (see **Figure 61**).

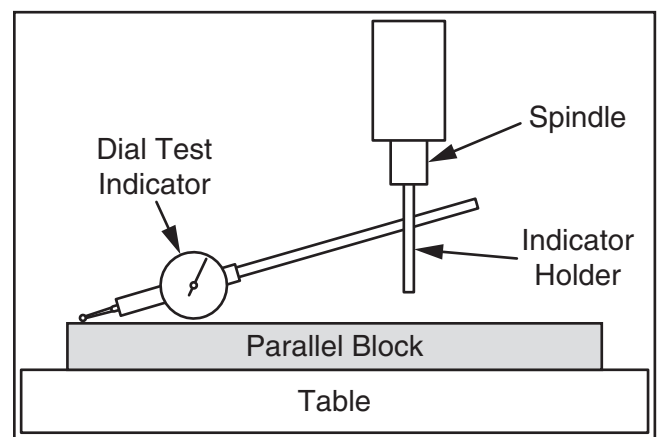


Figure 61. Dial test indicator mounted.



- To measure spindle alignment along X-axis, place parallel block directly under spindle and indicator across length of table, as illustrated in **Figure 62**.

Note: If you must re-position the quill or the knee to accommodate the above step, then review the tasks in **Step 2** to make sure the mill is properly prepared for trammung.

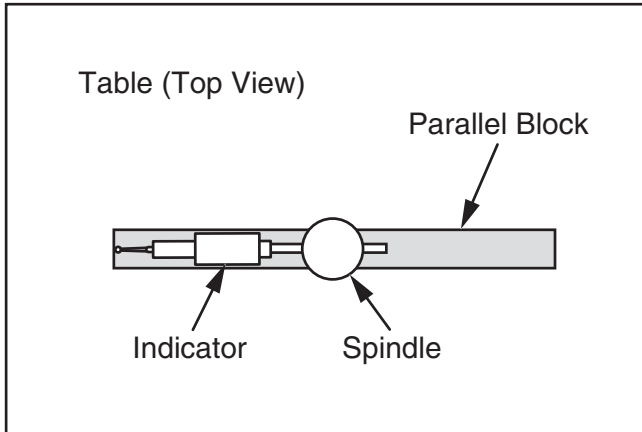


Figure 62. Parallel block and indicator positioned for the X-axis measurement (top view).

Note: Your general goal in the next steps should be to get the difference of the indicator readings between the ends of the parallel bar down to 0.0005". However, the acceptable variance will depend on the requirements for your operation.

- Rotate spindle by hand so that indicator point rests on one end of parallel block, as illustrated in **Figures 61–62**, then zero the dial.
- Rotate spindle so that indicator point rests in same manner on other end of block, then read dial.

—If the indicator dial still reads zero or is within the acceptable variance, continue on with **Step 8**.

—If the indicator dial has moved from zero beyond the acceptable variance, you will need to compensate for that amount by rotating the head left or right. Repeat **Steps 6–7** until you are satisfied with the spindle axis alignment along the table X-axis.

Note: Keep one of the rotation lock bolts just snug so the head does not move loosely while you adjust it. Remember to tighten all the rotation lock bolts after adjusting the head.

- Place parallel block directly under spindle and across width of table, as illustrated in **Figure 63**.
- Rotate spindle so indicator point rests on parallel bar, as illustrated in **Figure 63**, then zero the dial.

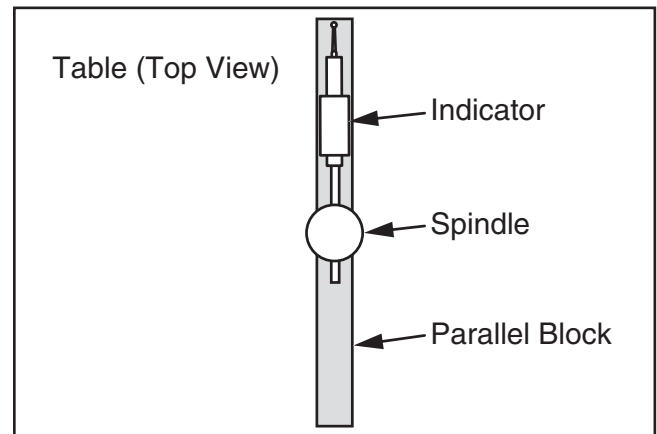


Figure 63. Parallel block and indicator positioned for the Y-axis measurement (top view).

- Rotate spindle so that indicator point rests on other end of bar in same manner, then read dial.

—If the indicator dial still reads zero or is within the acceptable variance, the spindle is precisely perpendicular to the table in both the X- and Y-axis, and the trammung procedure is complete.

—If the indicator dial has moved from zero beyond the acceptable variance, you will need to compensate for that amount by tilting the head forward or backward. Repeat **Steps 9–10** until you are satisfied with the spindle axis alignment along the table Y-axis.

Note: Keep one of the tilt lock bolts just snug so the head does not move loosely while you adjust it. Remember to tighten all the tilt lock bolts after adjusting the head.



SECTION 8: WIRING

These pages are current at the time of printing. However, in the spirit of improvement, we may make changes to the electrical systems of future machines. Compare the manufacture date of your machine to the one stated in this manual, and study this section carefully.

If there are differences between your machine and what is shown in this section, call Technical Support at (570) 546-9663 for assistance BEFORE making any changes to the wiring on your machine. An updated wiring diagram may be available. **Note:** *Please gather the serial number and manufacture date of your machine before calling. This information can be found on the main machine label.*

WARNING

Wiring Safety Instructions

SHOCK HAZARD. Working on wiring that is connected to a power source is extremely dangerous. Touching electrified parts will result in personal injury including but not limited to severe burns, electrocution, or death. Disconnect the power from the machine before servicing electrical components!

MODIFICATIONS. Modifying the wiring beyond what is shown in the diagram may lead to unpredictable results, including serious injury or fire. This includes the installation of unapproved after-market parts.

WIRE CONNECTIONS. All connections must be tight to prevent wires from loosening during machine operation. Double-check all wires disconnected or connected during any wiring task to ensure tight connections.

CIRCUIT REQUIREMENTS. You MUST follow the requirements at the beginning of this manual when connecting your machine to a power source.

WIRE/COMPONENT DAMAGE. Damaged wires or components increase the risk of serious personal injury, fire, or machine damage. If you notice that any wires or components are damaged while performing a wiring task, replace those wires or components.

MOTOR WIRING. The motor wiring shown in these diagrams is current at the time of printing but may not match your machine. If you find this to be the case, use the wiring diagram inside the motor junction box.
















CAPACITORS/INVERTERS. Some capacitors and power inverters store an electrical charge for up to 10 minutes after being disconnected from the power source. To reduce the risk of being shocked, wait at least this long before working on capacitors.

EXPERIENCING DIFFICULTIES. If you are experiencing difficulties understanding the information included in this section, contact our Technical Support at (570) 546-9663.

NOTICE

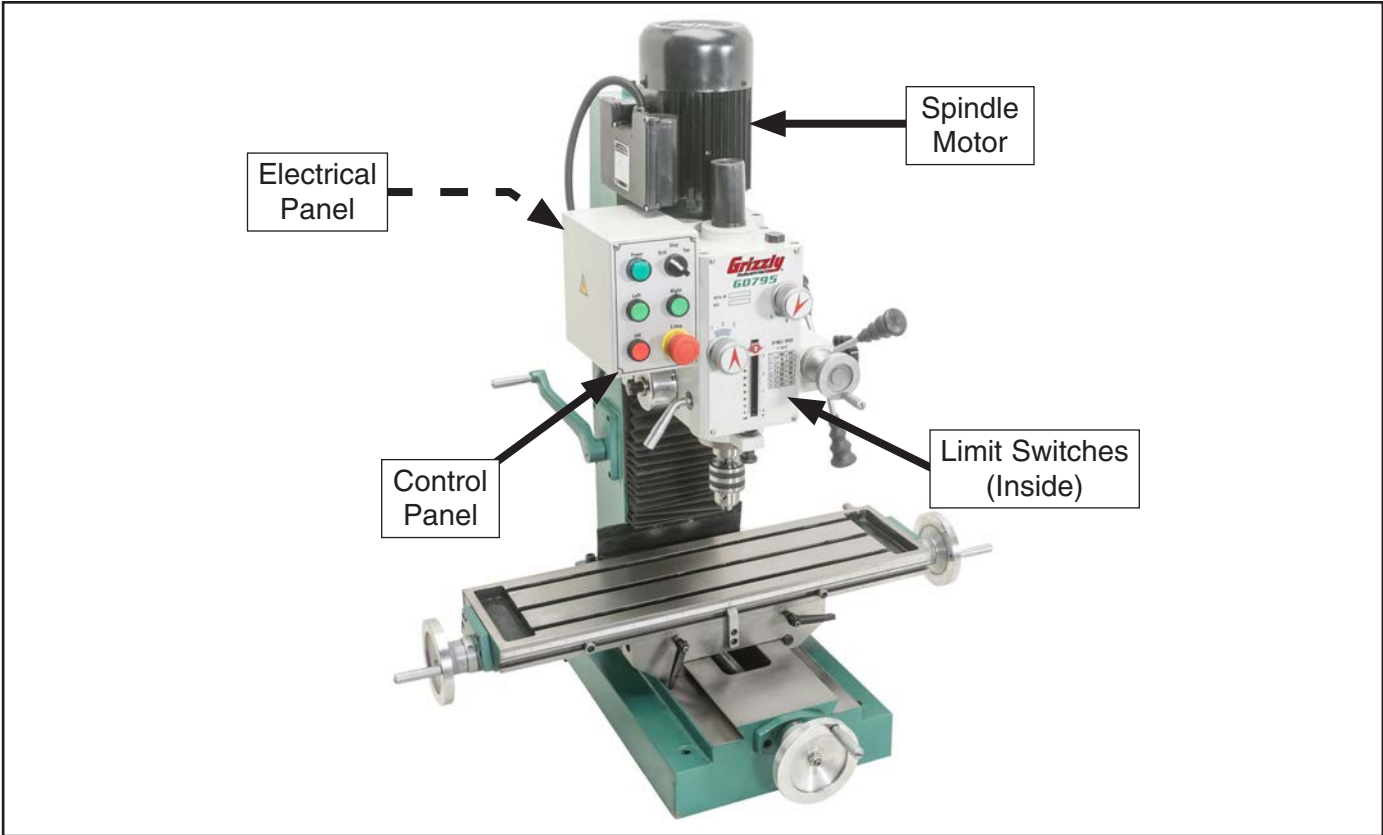
The photos and diagrams included in this section are best viewed in color. You can view these pages in color at www.grizzly.com.

COLOR KEY

BLACK 	BLUE 	YELLOW 	LIGHT BLUE 
WHITE 	BROWN 	YELLOW GREEN 	BLUE WHITE 
GREEN 	GRAY 	PURPLE 	TURQUOISE 
RED 	ORANGE 	PINK 	



Component Location



Spindle Motor Wiring Diagram

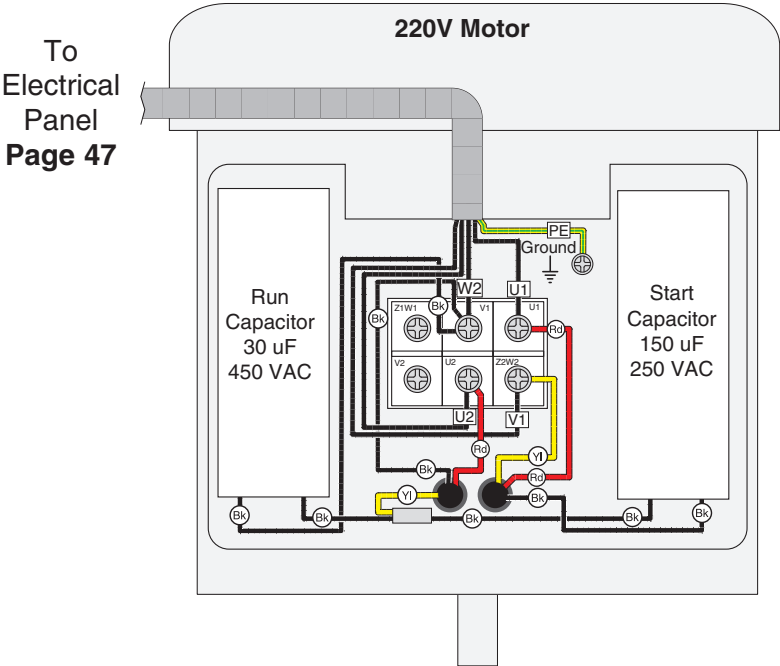


Figure 64. Motor Wiring



Main Wiring Diagram

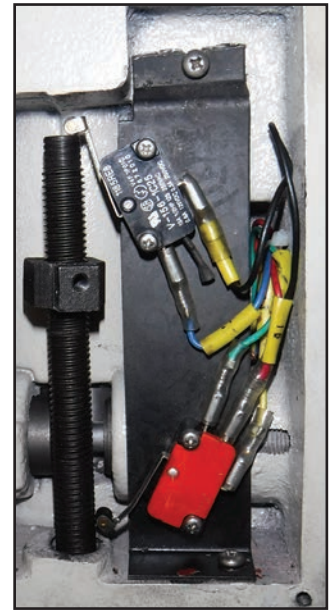
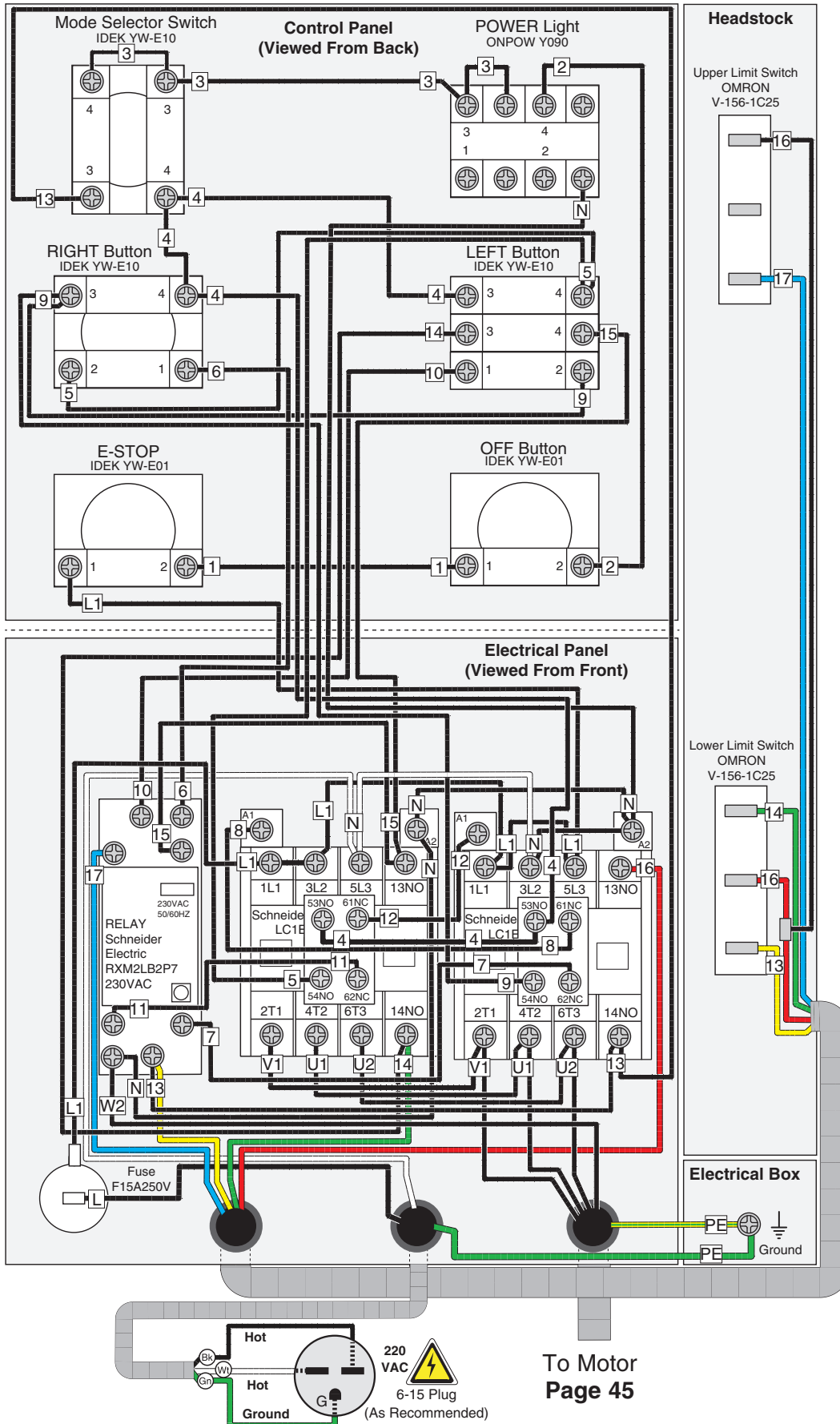


Figure 65. Limit switch wiring.



Main Wiring Photos

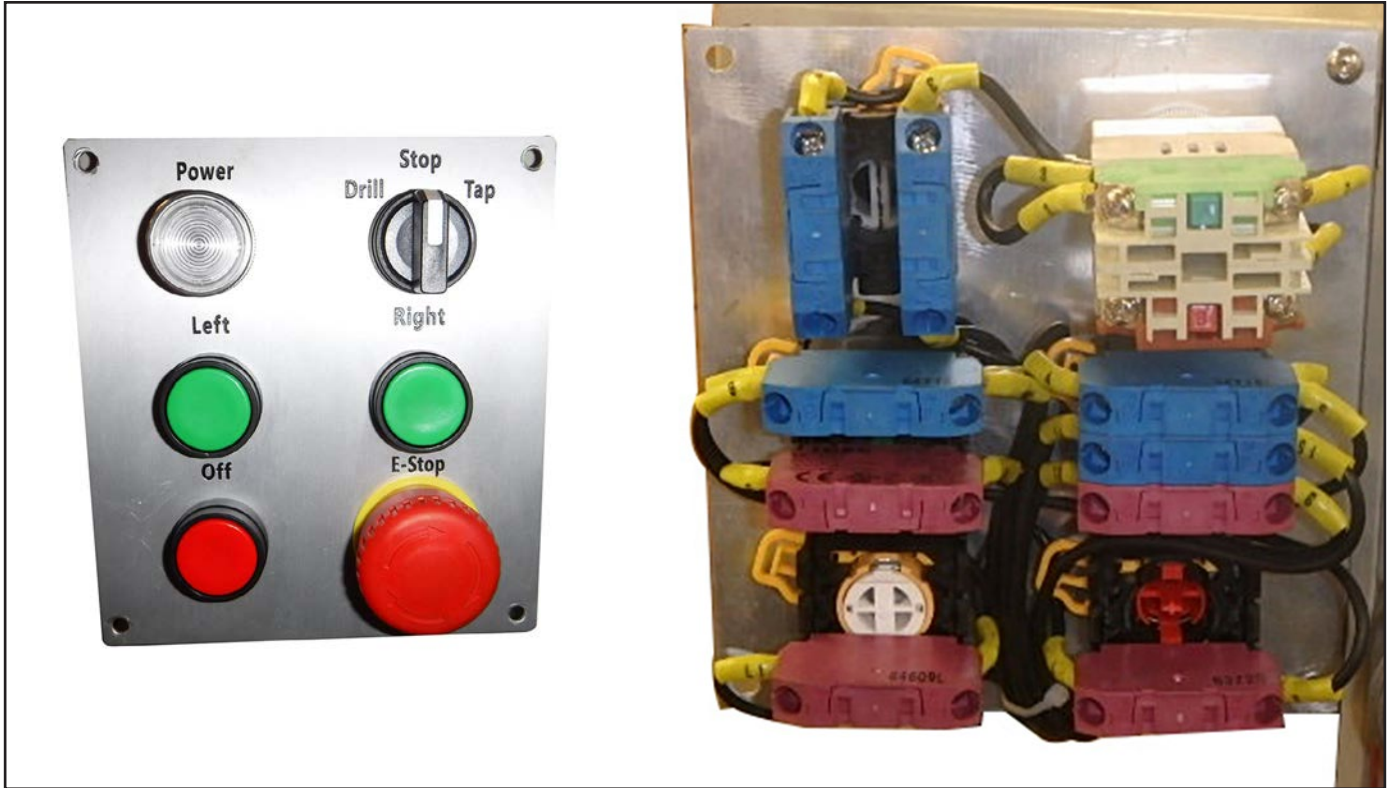


Figure 66. Control panel wiring.

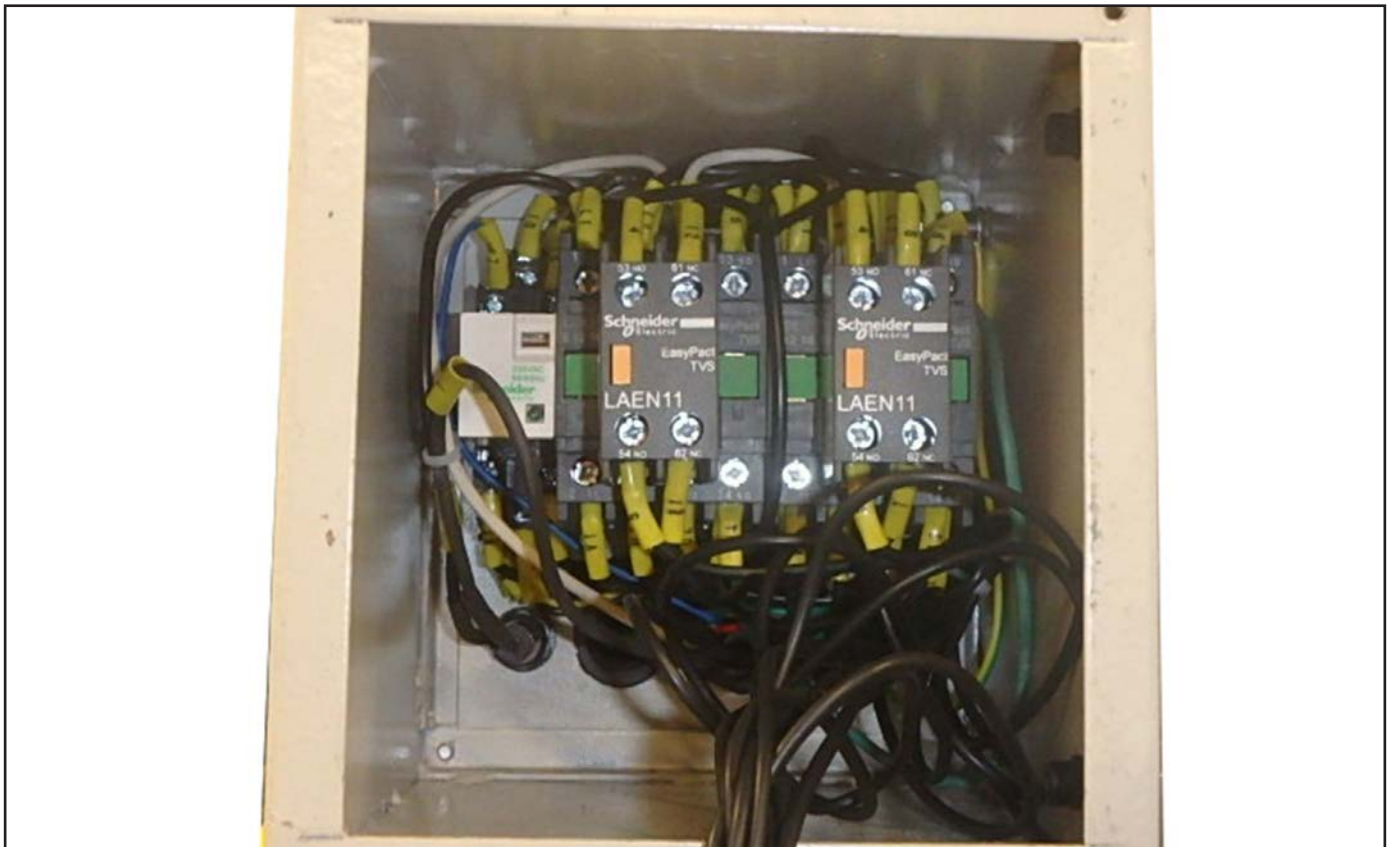
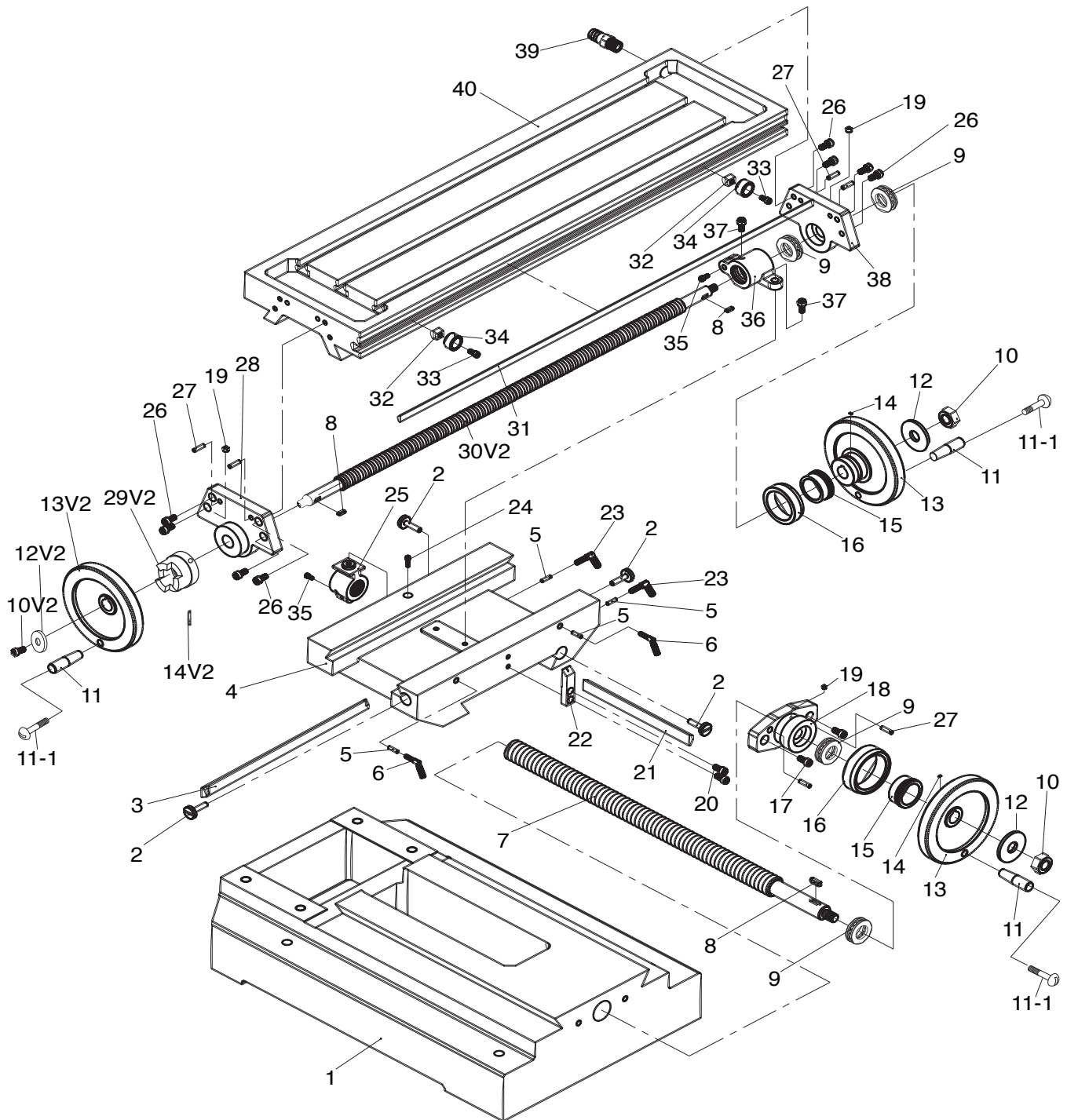


Figure 67. Electrical panel wiring.

SECTION 9: PARTS

Please Note: We do our best to stock replacement parts whenever possible, but we cannot guarantee that all parts shown here are available for purchase. Call (800) 523-4777 or visit our online parts store at www.grizzly.com to check for availability.

Table & Base



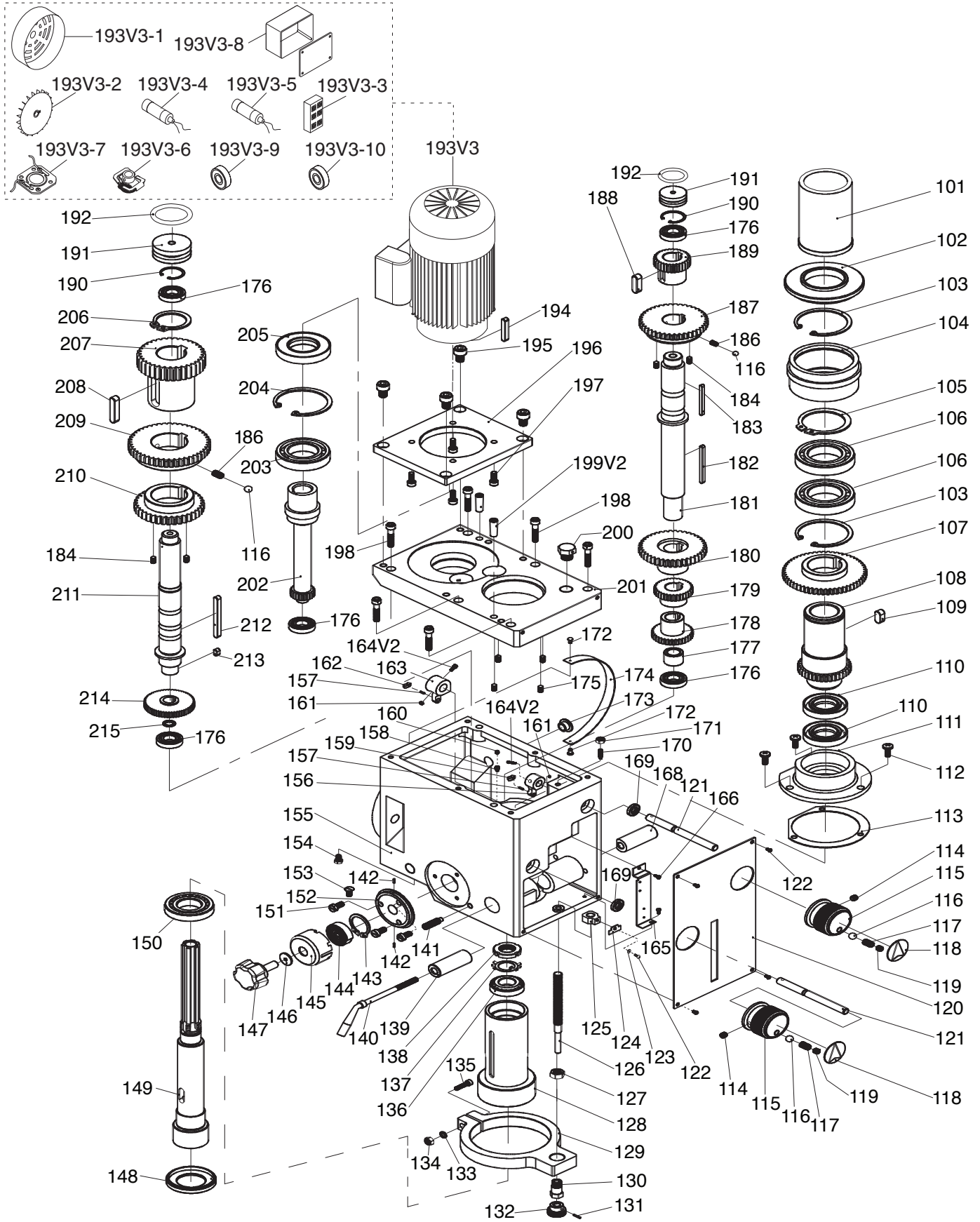
Base Parts List

REF	PART #	DESCRIPTION
1	P0795001	BASE CASTING
2	P0795002	GIB SCREW M6-1 X 25
3	P0795003	WORKTABLE GIB
4	P0795004	WORKTABLE SADDLE
5	P0795005	DOWEL PIN 6 X 12
6	P0795006	ADJUSTABLE HANDLE 63L, M8-1.25 X 25
7	P0795007	Y-AXIS LEADSCREW
8	P0795008	KEY 5 X 5 X 16
9	P0795009	THRUST BEARING 51103
10	P0795010	LOCK NUT M10-1.5
10V2	P0795010V2	CAP SCREW M6-1 X 12
11	P0795011	HANDLE W/OUT SHAFT 22 X 80, 12D
11-1	P0795011-1	SHOULDER SCR M10-1.5 X 12, 12 X 87
12	P0795012	FLAT WASHER 10MM
12V2	P0795012V2	FENDER WASHER 6MM
13	P0795013	HANDWHEEL TYPE-8 125DX16B-K X M10-1.5 V1
13V2	P0795013V2	HANDWHEEL TYPE-10 125DX17B-NXM8-1.25 V2
14	P0795014	HANDWHEEL SPRING
14V2	P0795014V2	ROLL PIN 5 X 35
15	P0795015	GRADUATED DIAL
16	P0795016	GRADUATED DIAL SEAT
17	P0795017	CAP SCREW M8-1.25 X 20
18	P0795018	Y-AXIS LEADSCREW BRACKET

REF	PART #	DESCRIPTION
19	P0795019	BALL OILER 6MM PRESS-IN
20	P0795020	CAP SCREW M6-1 X 12
21	P0795021	Y-AXIS GIB
22	P0795022	X-AXIS STOP BLOCK W/INDICATOR
23	P0795023	ADJUSTABLE HANDLE 40L, M8-1.25 X 25
24	P0795024	CAP SCREW M8-1.25 X 50
25	P0795025	Y-AXIS LEADSCREW NUT
26	P0795026	CAP SCREW M6-1 X 20
27	P0795027	INT THREADED TAPER PIN 6 X 12
28	P0795028	X-AXIS LEADSCREW BRACKET (L)
29V2	P0795029V2	HANDWHEEL CLUTCH
30V2	P0795030V2	X-AXIS LEADSCREW V2.01.17
31	P0795031	X-AXIS TABLE SCALE
32	P0795032	SQUARE NUT M6-1
33	P0795033	CAP SCREW M6-1 X 14
34	P0795034	STOP BLOCK
35	P0795035	CAP SCREW M5-.8 X 20
36	P0795036	X-AXIS LEADSCREW NUT
37	P0795037	CAP SCREW M6-1 X 25
38	P0795038	X-AXIS LEADSCREW BRACKET (R)
39	P0795039	HOSE CONNECTOR M16-2 X 15
40	P0795040	TABLE



Headstock



Headstock Parts List

REF	PART #	DESCRIPTION
101	P0795101	DRAWBAR CAP
102	P0795102	SEAL SEAT
103	P0795103	INT RETAINING RING 62MM
104	P0795104	BEARING SEAT
105	P0795105	EXT RETAINING RING 35MM
106	P0795106	BALL BEARING 6006-OPEN
107	P0795107	GEAR 57T
108	P0795108	SPINDLE HOUSING
109	P0795109	KEY 8 X 8 X 14
110	P0795110	OIL SEAL 30 X 42 X 7
111	P0795111	OIL SEAL SLEEVE
112	P0795112	PHLP HD SCR M5-.8 X 16
113	P0795113	OIL SEAL SLEEVE GASKET
114	P0795114	SET SCREW M6-1 X 10 CONE-PT
115	P0795115	GEAR KNOB 45D
116	P0795116	STEEL BALL 6.5MM
117	P0795117	COMPRESSION SPRING .8 X 5 X 25
118	P0795118	GEAR KNOB LABEL
119	P0795119	SET SCREW M8-1.25 X 8
120	P0795120	CONTROL FACEPLATE
121	P0795121	SPEED SHIFT SHAFT
122	P0795122	BUTTON HD CAP SCR M4-.7 X 6
123	P0795123	FLAT WASHER 4MM
124	P0795124	DEPTH INDICATOR
125	P0795125	DEPTH ADJ NUT M12-1.5
126	P0795126	DEPTH ADJ SCREW M12-1.5, M12-2
127	P0795127	HEX NUT M14-2 THIN
128	P0795128	SPINDLE SLEEVE
129	P0795129	DEPTH SUPPORT RING
130	P0795130	SCREW SLEEVE M14-2
131	P0795131	ROLL PIN 3 X 14
132	P0795132	KNURLED KNOB 14L X 25D
133	P0795133	LOCK WASHER 6MM
134	P0795134	HEX NUT M6-1
135	P0795135	CAP SCREW M6-1 X 35
136	P0795136	TAPERED ROLLER BEARING 30205
137	P0795137	TOOTHED WASHER 25MM
138	P0795138	SPANNER NUT M25-1.5
139	P0795139	QUILL LOCK SLEEVE (L)
140	P0795140	QUILL LOCK HANDLE
141	P0795141	SET SCREW M10-1.5 X 35 DOG-PT
142	P0795142	ROLL PIN 3 X 12
143	P0795143	EXT RETAINING RING 18MM
144	P0795144	FLAT COIL SPRING
145	P0795145	RETURN SPRING HOUSING

REF	PART #	DESCRIPTION
146	P0795146	FLAT WASHER 6 X 28 X 2.4MM
147	P0795147	KNOB BOLT 5-LOBE M6-1 X 18, 30D X 25L
148	P0795148	SPINDLE END CAP
149	P0795149	SPINDLE
150	P0795150	TAPERED ROLLER BEARING 30207
151	P0795151	PHLP HD SCR M5-.8 X 10
152	P0795152	COIL SEAT
153	P0795153	FLAT HD SCR M5-.8 X 10
154	P0795154	DRAIN PLUG M12-1
155	P0795155	HEADSTOCK CASTING
156	P0795156	GEAR COLLAR (FRONT)
157	P0795157	ROLL PIN 4 X 10
158	P0795158	SET SCREW M6-1 X 10 LONG DOG-PT
159	P0795159	COPPER BLOCK (FRONT)
160	P0795160	SET SCREW M6-1 X 8
161	P0795161	HEX NUT M6-1
162	P0795162	COPPER BLOCK (REAR)
163	P0795163	GEAR COLLAR (REAR)
164V2	P0795164V2	FLAT HD CAP SCR M4-.7 X 14 V2.06.17
165	P0795165	SWITCH BRACKET
166	P0795166	PHLP HD SCR M4-.7 X 8
168	P0795168	QUILL LOCK SLEEVE (R)
169	P0795169	OIL SEAL 10 X 22 X 7
170	P0795170	SET SCREW M6-1 X 20 LONG DOG-PT
171	P0795171	HEX NUT M6-1
172	P0795172	RIVET 2.5 X 5 FLUTED
173	P0795173	OIL SIGHT M16 X 1.5
174	P0795174	HEADSTOCK ANGLE GAUGE
175	P0795175	SET SCREW M5-.8 X 10 CONE-PT
176	P0795176	BALL BEARING 6001-OPEN
177	P0795177	SPACER
178	P0795178	GEAR 27T
179	P0795179	GEAR 21T
180	P0795180	GEAR 36T
181	P0795181	SPINDLE SHAFT
182	P0795182	KEY 5 X 5 X 70
183	P0795183	KEY 5 X 5 X 36
184	P0795184	SET SCREW M5-.8 X 10 CONE-PT
186	P0795186	COMPRESSION SPRING
187	P0795187	GEAR 46T
188	P0795188	KEY 5 X 5 X 16
189	P0795189	GEAR 18T
190	P0795190	INT RETAINING RING 28MM
191	P0795191	HEADSTOCK PLUG



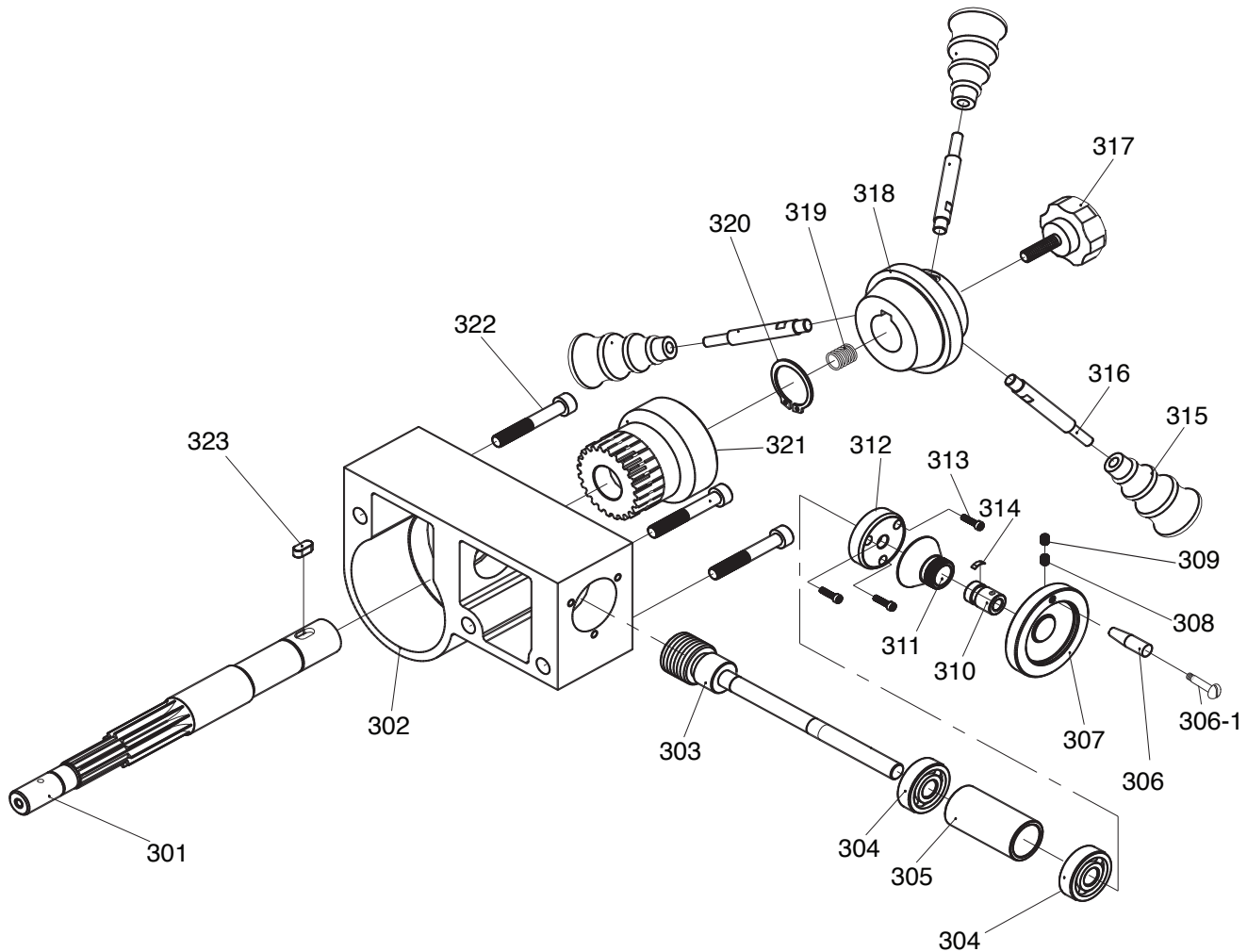
Headstock Parts List (cont.)

REF	PART #	DESCRIPTION
192	P0795192	O-RING 23.7 X 3.5 P24
193V3	P0795193V3	MOTOR 1HP 220V 1-PH V3.02.19
193V3-1	P0795193V3-1	MOTOR FAN COVER
193V3-2	P0795193V3-2	MOTOR FAN
193V3-3	P0795193V3-3	TERMINAL BLOCK 3P
193V3-4	P0795193V3-4	R CAPACITOR 30M 450V 1-3/4 X 3-3/16
193V3-5	P0795193V3-5	S CAPACITOR 150M 250V 1-3/8 X 3-3/16
193V3-6	P0795193V3-6	CENTRIFUGAL SWITCH
193V3-7	P0795193V3-7	CONTACT PLATE
193V3-8	P0795193V3-8	JUNCTION BOX
193V3-9	P0795193V3-9	BALL BEARING 6204ZZ
193V3-10	P0795193V3-10	BALL BEARING 6204ZZ
194	P0795194	KEY 6 X 6 X 36
195	P0795195	CAP SCREW M8-1.25 X 12
196	P0795196	MOTOR MOUNTING PLATE
197	P0795197	CAP SCREW M6-1 X 16
198	P0795198	CAP SCREW M6-1 X 40

REF	PART #	DESCRIPTION
199V2	P0795199V2	TAPER PIN 8 X 40 V2.06.17
200	P0795200	OIL PLUG BOLT M16-1.5 X 15
201	P0795201	HEADSTOCK COVER
202	P0795202	MOTOR SHAFT
203	P0795203	BALL BEARING 6006-OPEN
204	P0795204	INT RETAINING RING 55MM
205	P0795205	OIL SEAL 30 X 55 X 10
206	P0795206	EXT RETAINING RING 16MM
207	P0795207	GEAR 23T
208	P0795208	KEY 6 X 6 X 25
209	P0795209	GEAR 38T
210	P0795210	GEAR 32T
211	P0795211	MOTOR GEAR SHAFT
212	P0795212	KEY 5 X 5 X 60
213	P0795213	KEY 5 X 5 X 10
214	P0795214	GEAR 41T
215	P0795215	SPACER



Downfeed Handle

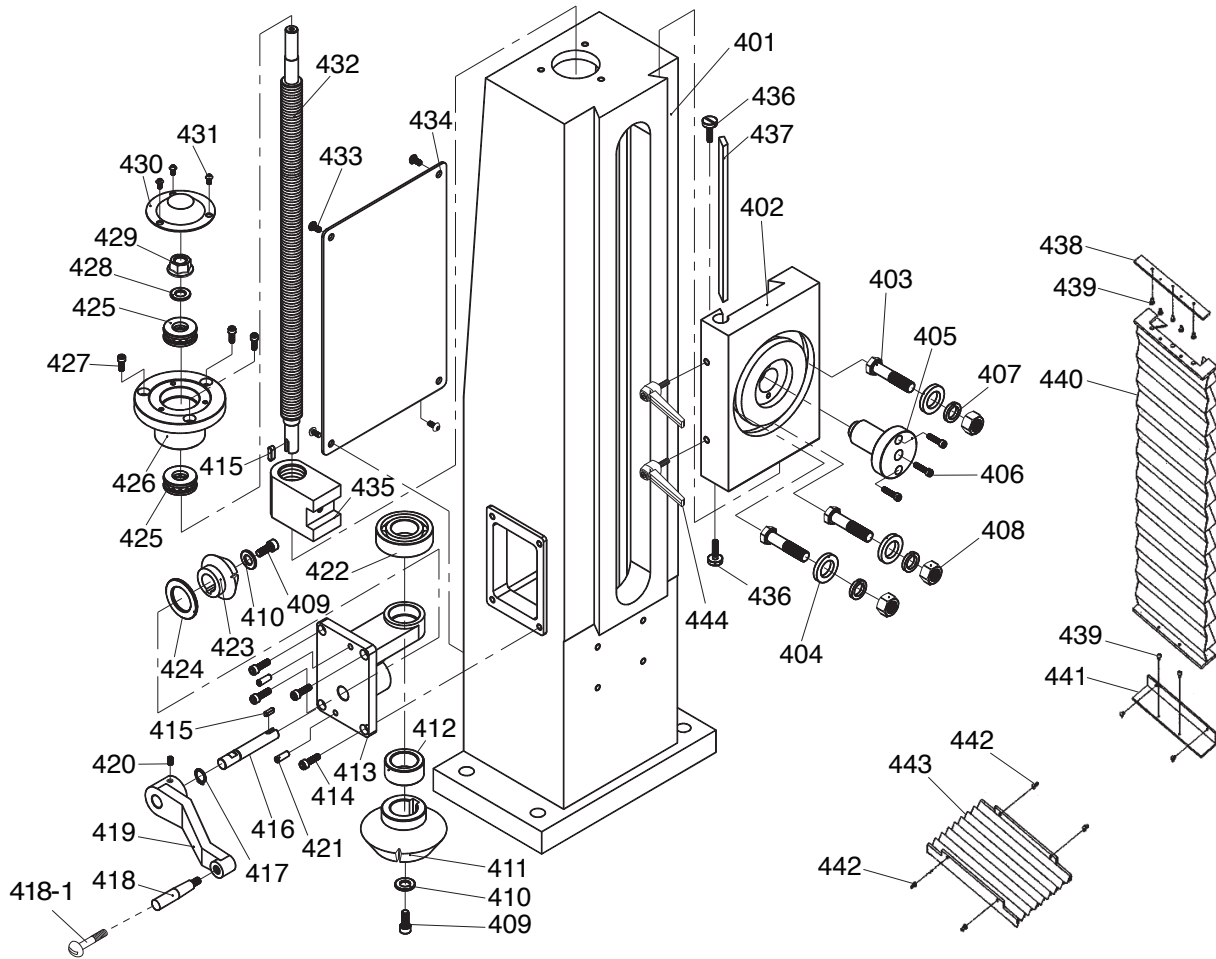


REF PART #	DESCRIPTION
301	P0795301 DOWNFEED GEAR SHAFT
302	P0795302 DOWNFEED GEAR SHAFT HOUSING
303	P0795303 WORM SHAFT
304	P0795304 BALL BEARING 6200-OPEN
305	P0795305 SPACER
306	P0795306 HANDLE W/OUT SHAFT 15 X 50, 8D
306-1	P0795306-1 SHOULDER SCR M6-1 X 10, 8 X 56
307	P0795307 HANDWHEEL TYPE-8 64D X 10B-S X M6-1
308	P0795308 SET SCREW M6-1 X 8
309	P0795309 SET SCREW M6-1 X 5
310	P0795310 HANDWHEEL SEAT
311	P0795311 GRADUATED DIAL

REF PART #	DESCRIPTION
312	P0795312 WORM SHAFT COVER
313	P0795313 CAP SCREW M4-.7 X 16
314	P0795314 HANDWHEEL CURVED PLATE SPRING
315	P0795315 HANDLE GRIP M8-1.25
316	P0795316 STANDOFF 100L M10-1.5 X 10, M8-1.25 X 25
317	P0795317 KNOB BOLT 7-L, M10-1.5 X 35, 62D X 43L
318	P0795318 COARSE DOWNFEED HUB
319	P0795319 COMPRESSION SPRING
320	P0795320 EXT RETAINING RING 25MM
321	P0795321 WORM GEAR
322	P0795322 CAP SCREW M8-1.25 X 55
323	P0795323 KEY 8 X 8 X 16



Column

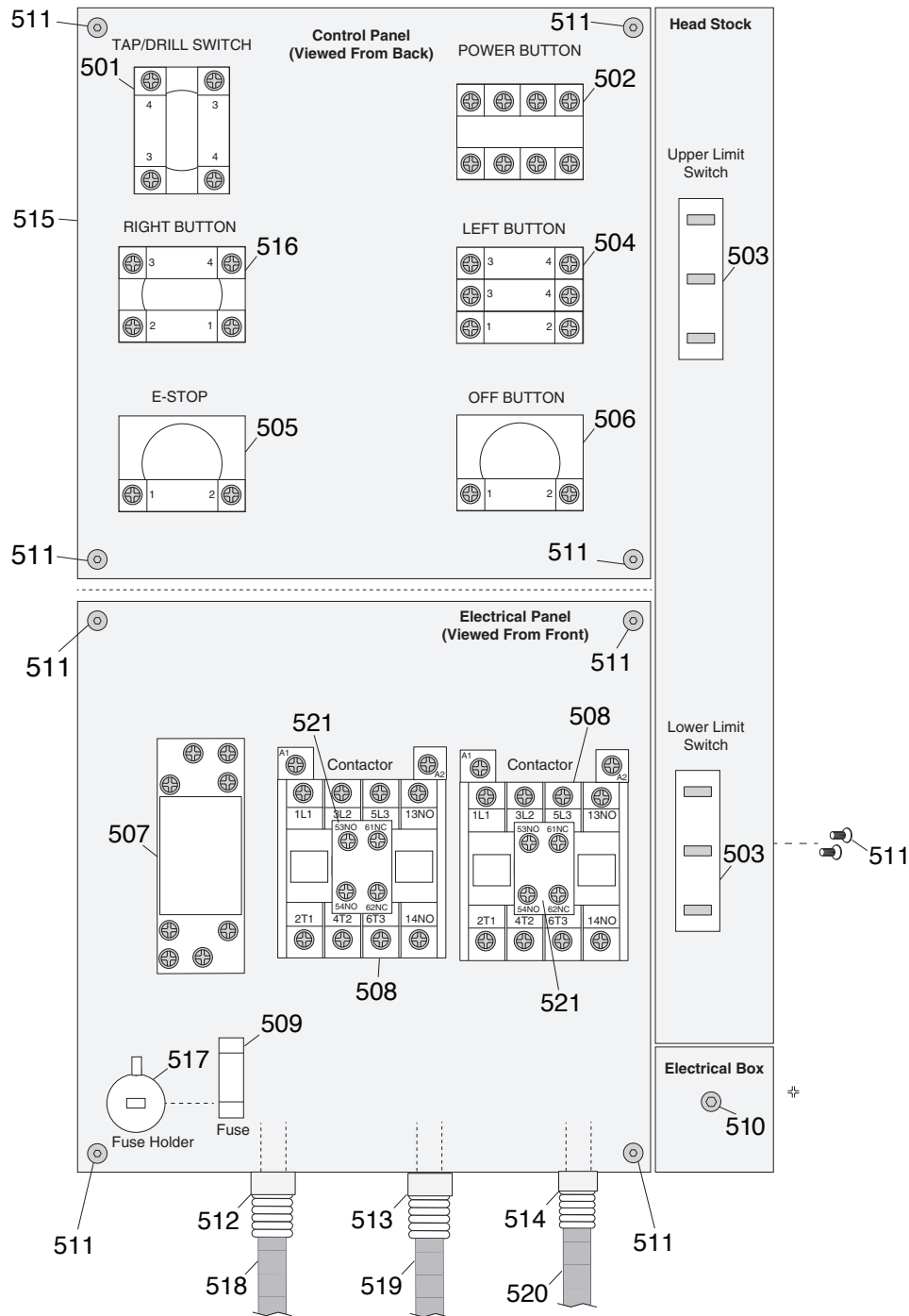


REF	PART #	DESCRIPTION
401	P0795401	COLUMN
402	P0795402	HEADSTOCK MOUNT
403	P0795403	HEX BOLT M12-1.75 X 55
404	P0795404	FLAT WASHER 12MM
405	P0795405	HEADSTOCK SEAT
406	P0795406	CAP SCREW M6-1 X 25
407	P0795407	LOCK WASHER 12MM
408	P0795408	HEX NUT M12-1.75
409	P0795409	CAP SCREW M6-1 X 14
410	P0795410	FLAT WASHER 6MM
411	P0795411	BEVEL GEAR
412	P0795412	BUSHING
413	P0795413	Z-AXIS LEADSCREW BRACKET
414	P0795414	CAP SCREW M6-1 X 20
415	P0795415	KEY 5 X 5 X 16
416	P0795416	CRANK SHAFT
417	P0795417	EXT RETAINING RING 15MM
418	P0795418	HANDLE W/OUT SHAFT 22 X 80, 12D
418-1	P0795418-1	SHOULDER SCR M10-1.5 X 12, 12 X 87
419	P0795419	Z-AXIS CRANK HANDLE
420	P0795420	SET SCREW M8-1.25 X 8
421	P0795421	TAPER PIN 6 X 18
422	P0795422	BALL BEARING 6002-OPEN

REF	PART #	DESCRIPTION
423	P0795423	SMALL BEVEL GEAR
424	P0795424	BEVEL PAD
425	P0795425	THRUST BEARING 51202
426	P0795426	BEARING SEAT
427	P0795427	CAP SCREW M6-1 X 14
428	P0795428	FLAT WASHER 14MM
429	P0795429	FLANGE NUT M14-2
430	P0795430	TOP COVER
431	P0795431	BUTTON HD CAP SCR M4-.7 X 8
432	P0795432	Z-AXIS LEADSCREW
433	P0795433	CAP SCREW M5-.8 X 8
434	P0795434	BACK COVER
435	P0795435	Z-AXIS LEADSCREW NUT
436	P0795436	GIB ADJUSTMENT SCREW M6-1 X 25
437	P0795437	COLUMN GIB
438	P0795438	Z-AXIS WAY COVER UPPER PLATE
439	P0795439	PHLP HD SCR M4-.7 X 6
440	P0795440	Z-AXIS WAY COVER
441	P0795441	Z-AXIS WAY COVER LOWER BRACKET
442	P0795442	PHLP HD SCR M5-.8 X 12
443	P0795443	Y-AXIS WAY COVER
444	P0795444	ADJUSTABLE HANDLE 63L, M8-1.25 X 25



Electrical Components

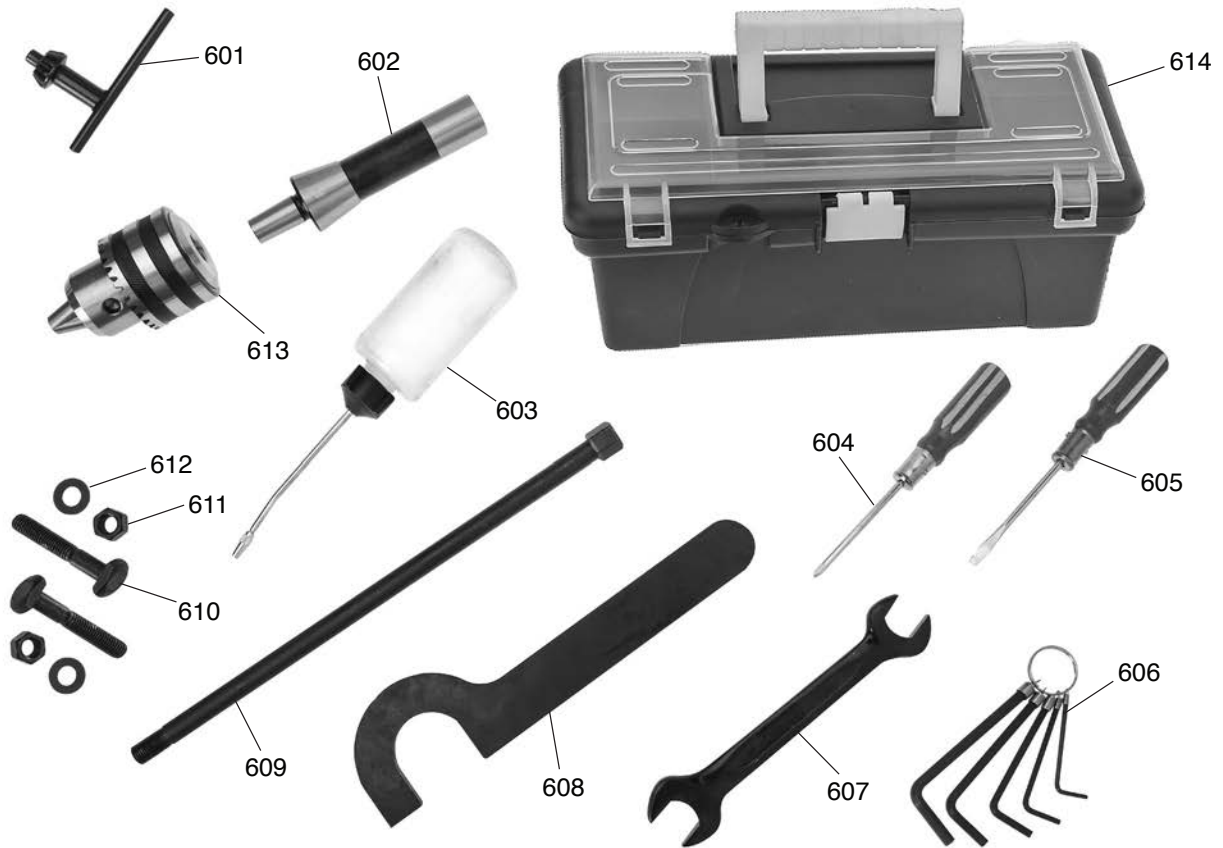


REF PART #	DESCRIPTION
501	P0795501 TAP/DRILL SWITCH IDEK YW-E10
502	P0795502 POWER INDICATOR LIGHT ONPOW Y090
503	P0795503 LIMIT SWITCH OMRON V-156-1C25
504	P0795504 LEFT BUTTON SWITCH IDEK YW-E10 22MM GRN
505	P0795505 E-STOP BUTTON IDEK YW-E01 22MM
506	P0795506 OFF BUTTON IDEK YW-E01 22MM RED
507	P0795507 RELAY SCHN RXM2LB2P7230V
508	P0795508 CONTACTOR SCHN LC1E1210 220V
509	P0795509 FUSE 15A 250V 0.18" FAST-ACTING, GLASS
510	P0795510 CAP SCREW M5-.8 X 10
511	P0795511 BUTTON HD CAP SCR M4-.7 X 6

REF PART #	DESCRIPTION
512	P0795512 STRAIN RELIEF TYPE-5 M20-1.5
513	P0795513 STRAIN RELIEF TYPE-3 M20-1.5
514	P0795514 STRAIN RELIEF TYPE-5 M16-1.5
515	P0795515 ELECTRICAL BOX
516	P0795516 RIGHT BUTTON SWITCH IDEK YW-E10 22MM GRN
517	P0795517 FUSE HOLDER 15A 250V
518	P0795518 CONDUIT 16MM X 18"
519	P0795519 POWER CORD 16G 3W 68"
520	P0795520 CONDUIT 13MM X 9-1/2"
521	P0795521 AUX CONTACT BLOCK SCHN LAEN11N 220V



Accessories

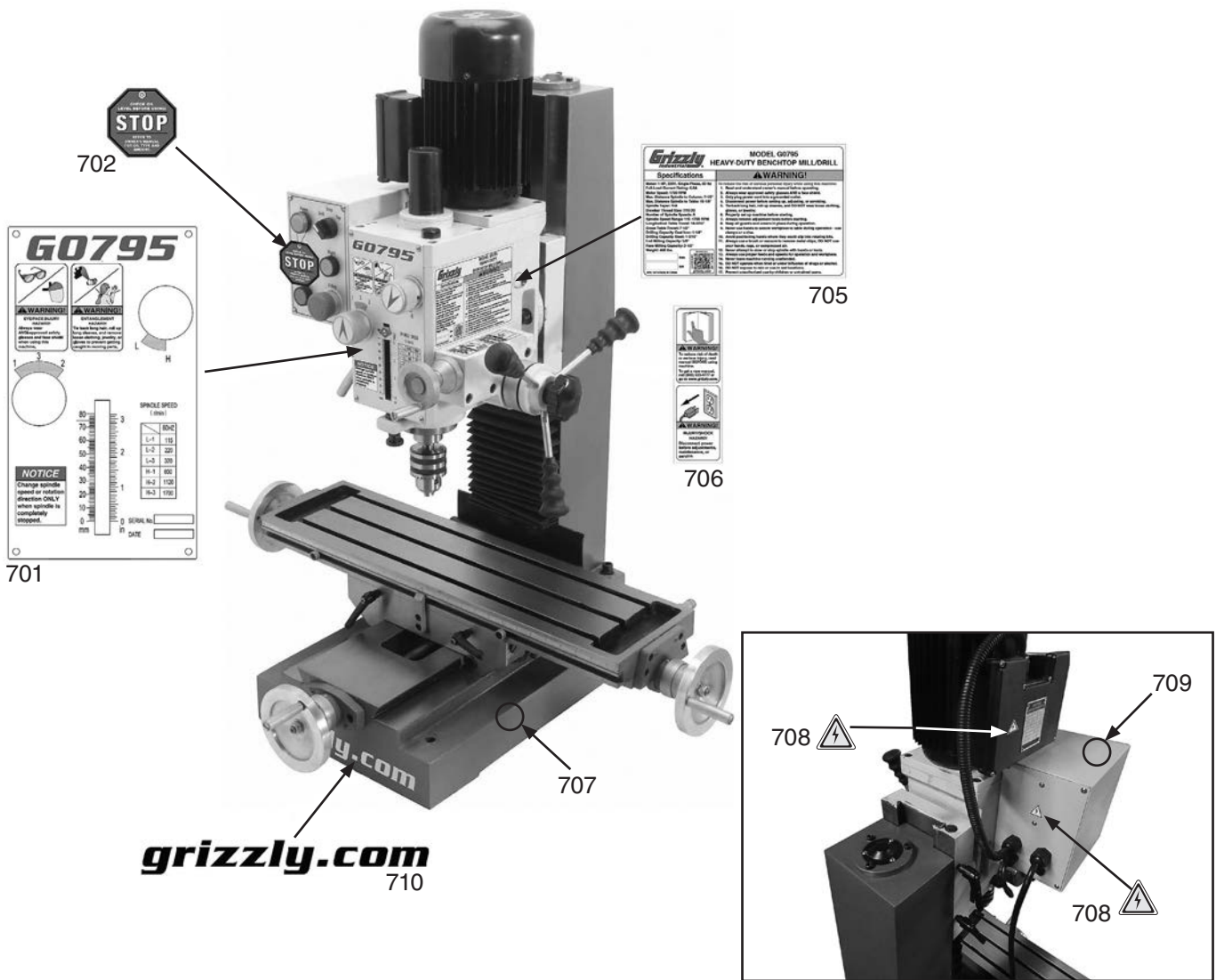


REF	PART #	DESCRIPTION
601	P0795601	DRILL CHUCK KEY 5/16" STD 11T SD-5/8"
602	P0795602	DRILL CHUCK ARBOR R8 X B16
603	P0795603	BOTTLE FOR OIL
604	P0795604	SCREWDRIVER PHILLIPS #2
605	P0795605	SCREWDRIVER FLAT #2
606	P0795606	HEX WRENCH SET (5-PC)
607	P0795607	WRENCH 17 X 19MM OPEN-ENDS

REF	PART #	DESCRIPTION
608	P0795608	SPINDLE WRENCH 40MM
609	P0795609	DRAWBAR 7/16-20 X 12"
610	P0795610	T-BOLT M10-1.5 X 60
611	P0795611	HEX NUT M10-1.5
612	P0795612	FLAT WASHER 10MM
613	P0795613	DRILL CHUCK B16 3-16MM
614	P0795614	TOOLBOX



Labels & Cosmetics



REF PART #	DESCRIPTION
701	P0795701 HEADSTOCK FACE PLATE
702	P0795702 OIL LEVEL WARNING LABEL TAG
705	P0795705 MACHINE ID LABEL
706	P0795706 READ MANUAL-DISCONNECT PWR LABEL

REF PART #	DESCRIPTION
707	P0795707 TOUCH-UP PAINT, GRIZZLY GREEN
708	P0795708 ELECTRICITY LABEL
709	P0795709 TOUCH-UP PAINT, GRIZZLY PUTTY
710	P0795710 GRIZZLY.COM LABEL

⚠ WARNING

Safety labels help reduce the risk of serious injury caused by machine hazards. If any label comes off or becomes unreadable, the owner of this machine **MUST** replace it in the original location before resuming operations. For replacements, contact (800) 523-4777 or www.grizzly.com.







WARRANTY CARD

Name _____
 Street _____
 City _____ State _____ Zip _____
 Phone # _____ Email _____
 Model # _____ Order # _____ Serial # _____

The following information is given on a voluntary basis. It will be used for marketing purposes to help us develop better products and services. **Of course, all information is strictly confidential.**

1. How did you learn about us?

Advertisement Friend Catalog
 Card Deck Website Other:

2. Which of the following magazines do you subscribe to?

<input type="checkbox"/> Cabinetmaker & FDM	<input type="checkbox"/> Popular Science	<input type="checkbox"/> Wooden Boat
<input type="checkbox"/> Family Handyman	<input type="checkbox"/> Popular Woodworking	<input type="checkbox"/> Woodshop News
<input type="checkbox"/> Hand Loader	<input type="checkbox"/> Precision Shooter	<input type="checkbox"/> Woodsmith
<input type="checkbox"/> Handy	<input type="checkbox"/> Projects in Metal	<input type="checkbox"/> Woodwork
<input type="checkbox"/> Home Shop Machinist	<input type="checkbox"/> RC Modeler	<input type="checkbox"/> Woodworker West
<input type="checkbox"/> Journal of Light Cont.	<input type="checkbox"/> Rifle	<input type="checkbox"/> Woodworker's Journal
<input type="checkbox"/> Live Steam	<input type="checkbox"/> Shop Notes	<input type="checkbox"/> Other:
<input type="checkbox"/> Model Airplane News	<input type="checkbox"/> Shotgun News	
<input type="checkbox"/> Old House Journal	<input type="checkbox"/> Today's Homeowner	
<input type="checkbox"/> Popular Mechanics	<input type="checkbox"/> Wood	

3. What is your annual household income?

\$20,000-\$29,000 \$30,000-\$39,000 \$40,000-\$49,000
 \$50,000-\$59,000 \$60,000-\$69,000 \$70,000+

4. What is your age group?

20-29 30-39 40-49
 50-59 60-69 70+

5. How long have you been a woodworker/metalworker?

0-2 Years 2-8 Years 8-20 Years 20+ Years

6. How many of your machines or tools are Grizzly?

0-2 3-5 6-9 10+

7. Do you think your machine represents a good value? Yes No

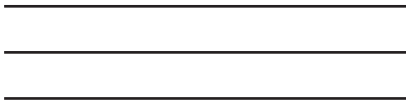
8. Would you recommend Grizzly Industrial to a friend? Yes No

9. Would you allow us to use your name as a reference for Grizzly customers in your area?
Note: We never use names more than 3 times. Yes No

10. Comments: _____

CUT ALONG DOTTED LINE

FOLD ALONG DOTTED LINE



Place
Stamp
Here



GRIZZLY INDUSTRIAL, INC.
P.O. BOX 2069
BELLINGHAM, WA 98227-2069



FOLD ALONG DOTTED LINE

Send a Grizzly Catalog to a friend:

Name	_____
Street	_____
City	_____ State _____ Zip _____

TAPE ALONG EDGES--PLEASE DO NOT STAPLE

WARRANTY & RETURNS

Grizzly Industrial, Inc. warrants every product it sells for a period of **1 year** to the original purchaser from the date of purchase. This warranty does not apply to defects due directly or indirectly to misuse, abuse, negligence, accidents, repairs or alterations or lack of maintenance. This is Grizzly's sole written warranty and any and all warranties that may be implied by law, including any merchantability or fitness, for any particular purpose, are hereby limited to the duration of this written warranty. We do not warrant or represent that the merchandise complies with the provisions of any law or acts unless the manufacturer so warrants. In no event shall Grizzly's liability under this warranty exceed the purchase price paid for the product and any legal actions brought against Grizzly shall be tried in the State of Washington, County of Whatcom.

We shall in no event be liable for death, injuries to persons or property or for incidental, contingent, special, or consequential damages arising from the use of our products.

To take advantage of this warranty, contact us by mail or phone and give us all the details. We will then issue you a "Return Number," which must be clearly posted on the outside as well as the inside of the carton. We will not accept any item back without this number. Proof of purchase must accompany the merchandise.

The manufacturers reserve the right to change specifications at any time because they constantly strive to achieve better quality equipment. We make every effort to ensure that our products meet high quality and durability standards and we hope you never need to use this warranty.

Please feel free to write or call us if you have any questions about the machine or the manual.

Thank you again for your business and continued support. We hope to serve you again soon.

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TOOL WEBSITE

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